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A STUDY OF THE EFFECTS OF HOMOGENEOUS GROUPING ON TEACHERS' GRADES GIVEN TO MATRICULATION STUDENTS IN THE GRADE X CORE SUBJECTS

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ABSTRACT

The subject of this study is one of the controversial issues which have developed from the concern of teachers and heads of departments about the final grades received by pupils classified into homogeneous groups. Such classification, with all its administrative problems, must prove of value to the school and the pupils or the effort is not worthwhile.

Because homogeneous grouping has only recently appeared in Edmonton high schools, there is some concern that teachers have not yet realized the implications of such grouping for evaluation of pupil achievement. Some pupils may, in fact, receive lower marks under this classification than they would otherwise receive under heterogeneous grouping. In particular, the lower achievers in the high ability groups may be under-rated because some teachers are reluctant to grade all their pupils high enough. Course enrichment and more adequate teaching, may, therefore, go unrewarded.

The major hypothesis of this study is that homogeneously grouped students will get higher marks than students of comparable ability who are not so grouped. A sub-hypothesis of this study is that the lower-ranked pupils within homogeneous classes of high ability will receive lower final marks than they would if they had been placed in classes of heterogeneous ability.

In this study the marks of grade ten pupils who were grouped on the basis of homogeneous achievement on the grade IX Department of Education examinations were compared with those of pupils of equal

ability in a school where pupils were grouped heterogeneously.

Analysis of the results received in grade nine by the pupils used in this study indicated that those entering the two high schools were comparable in achievement as measured by the Grade IX Department of Education examinations.

Although there was some evidence that grade ten pupils who were grouped homogeneously did receive superior marks in certain academic subjects, analysis of the data proved inconclusive. The fact that significantly higher grades were not assigned to homogeneously grouped pupils suggests the possibility that some teachers require assistance to analyze the varied class needs and how to plan suitable instruction. Furthermore, grading practices should be under continual supervision and possible revision to ensure the assignment of valid grades to all pupils.

ACKNOWLEDGEMENTS

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INTRODUCTION

The Cameron Commission on Education reports that: "The range of individual differences cannot be well served by a uniform curriculum."[1] This statement is followed by the recommendation, "That the general nature of the curriculum be so conceived as to provide appropriate differentiation at all school levels."[2] In their efforts to provide for individual differences, administrators of some schools are studying, or experimenting with, the desirability of placing students into homogeneous ability groups.

Springer recently listed the following six reasons supporting homogeneous grouping:

> . . . To encourage the teacher to provide equal time and challenge to every pupil commensurate with the pupil's ability.

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[1] Report of the Royal Commission on Education in Alberta, Edmonton: L. S. Wall, Printer to The Queen's Most Excellent Majesty, 1959. p. 88.

[2] Ibid., p. 88.

> . . . To conserve human resources and to provide our society with educated people prepared to contribute to society in accordance with their maximum abilities.
>
> . . . To pursue the democratic concept of education--that each pupil is entitled to the same amount of time, facilities, and opportunities to learn according to his ability as is every other student.
>
> . . . To reduce the span of abilities within a given class so that a teacher may cope adequately with the range of individual needs with regard to books, materials, and learning experiences commensurate with the abilities and needs of the students.
>
> . . . As based on the psychology of learning; bright youngsters can theorize more readily than slow learners; rapid learners require less drill than slow learners; rapid learners require more reason "why" than do slow learners; rapid learners need to believe that knowledge is worthwhile, respectable and approved in society more than are inability, mistakes, and slothfulness.
>
> . . . To encourage teachers of rapid learners to use new techniques, materials and resources which are more in line with today's knowledge and scientific progress and with the out-of-school experiences of youth.[1]

These reasons conform with recommendations contained in studies on the same subject undertaken twenty-three years ago.[2]

Until recently Edmonton high school students have not been classified on any basis other than choice of program. However, the development of the large composite high school has enabled administrators of certain high schools to implement homogeneous student placement on the basis of previous grade achievement.

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[1] Robert L. Springer, "Sewanhaka Policy Guide," The Clearing House, 33: 553-8. May, 1952.

[2] Roy O. Billett, "The Administration of Grouping in Secondary Schools," Thirty-Fifth Yearbook of the National Society for the Study of Education, Part 1. 1936 pp. 217-45.

Homogeneous grouping on such a basis aggravates the problem of the evaluation of student performance. Teachers are unconsciously influenced by external factors which influence the final grades awarded to the pupil.[1] There is, therefore, a definite need for an objective evaluation of the validity of teacher's marks under conditions of homogeneous grouping. Carter studying variables influencing teachers' marks found:

> That teachers' marks represent achievement, but, and this is important, they give evidence of the effect of intelligence, and social-economic status, the personality, the interest, and the age of the student upon the teacher.[2]

Because homogeneous grouping has only recently appeared in Edmonton high schools, there is some concern that teachers have not yet realized the implications of such grouping for evaluation of pupil grades. Some pupils may, in fact, receive lower marks under this classification than they would otherwise receive under heterogeneous grouping. This could be the effect of the traditionally held concept that marks should range from excellent to failure in each class. It may well be that the lower achievers in the high ability groups are under-rated due to the teachers' reluctance to grade all pupils high enough. Course enrichment and a better understanding of educational concepts that would be expected to be achieved by pupils in such classes, may, therefore,

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[1] Robert S. Carter, "Non-Intellectual Variables Involved in Teacher Marks," Journal of Educational Research, 47: 81-95, October, 1953

[2] Ibid., p. 92.

go unrewarded. Similarly, top-ranking students in low ability groups may be over-rated.

STATEMENT OF THE PROBLEM

Interest has been mounting among school administrators in grouping pupils on the basis of ability and achievement. The impact of this trend first affected the elementary schools where grouping has been used for reading and other instruction. The trend has not entered into the administrative planning in many high schools. Grouping in high school is made on various bases, of which, the most common are previous achievement and the program selected by the pupil. The advantages or disadvantages of such programming are a matter of controversy which will only be answered on the basis of future research.

The subject of this study is one of the controversial issues which have developed from the concern of teachers and heads of departments about the final grades received by pupils classified into homogeneous groups. Such classification, with all its administrative problems, must prove of value to the school and the pupils or the effort is not worthwhile. The validity of grades is one of the criteria of assessing the value of such organization. Teacher influence is obvious on final results in grades X and XI when Department of Education examinations are not held. Those teachers who have not accepted the concept of classes composed of pupils with very similar ability, may still attempt to "pigeon-hole" pupils in each class as superior, average and below-

average, thereby losing perspective of the entire program. Pupils falling in the below-average category in a superior class could possibly receive lower marks than if they had been placed in a heterogeneous class. Conversely a pupil whose results place him in the upper level of a below-average homogeneous group could possibly receive higher marks than if he had been placed in a heterogeneous class. Teachers who make such errors in grading practices apparently equate the enriched program of the high ability classes with the meagre core curriculum of the low ability classes.

Job placement after graduation, or the necessity of reliable grading for those who transfer schools, demands valid grading procedures. School marks which are affected by a pupil's level in a given group and possible teacher bias may adversely affect his future. The ramifications and impact of grading procedures on the present welfare and the future of all pupils suggest a need for an analytic comparison of the final results received by pupils grouped homogeneously or heterogeneously, to ascertain if a real problem of pupil evaluation exists.

This study proposes to compare pupil grades in a school where students are grouped in homogeneous classes with those of pupils of equal ability in a school where pupils are grouped heterogeneously.

Four of the five Edmonton composite high schools are presently using grade IX stanine scores to group pupils as homogeneously as possible. Due to large grade X enrolments, much of the registration and placement is done before school opening. Administrators responsible

for pupil placement have turned to the stanine standing as the only score of comparable data on each student and have grouped high school freshmen on that basis. The effect of this grouping on teacher grades and final results concerns the administration and teachers. There has been an effort, in some schools, to keep the mean achievement of each class in a position relative to the mean ability of the class. Lack of relationship of ability to position has resulted in discussions about teacher methods and marking practices. The study proposes to make the initial systematic analysis of such results.

DEFINITION OF TERMS

(1) Departmental examination results: Refer to the scores from achievement tests prepared and administered by the Department of Education.

(2) Matriculation program: A program of studies leading toward university entrance. The core subjects in Grade X being Language, Social Studies, Mathematics and Science.

(3) General program: Any program of studies leading toward a high school diploma, exclusive of the matriculation program.

(4) Homogeneous grouping: Classification of pupils on the basis of a common element. The common element in this study is the total stanine score received by the pupil taking six grade IX Department of Education examinations.

(5) Stanine: The norm population is divided into nine groups.

With the exception of stanine nine at the top of the distribution and stanine one at the bottom, the nine groups are spaced in units equal to one half the standard deviations.[1] The following percentages of the tested population are found in each stanine group:

TABLE I

THE STANINE DIVISION OF A NORM POPULATION

Stanine	Percentage of Population
1	4
2	7
3	12
4	17
5	20
6	17
7	12
8	7
9	4

(6) Heterogeneous grouping: Classification by random assignment of pupils to grade ten classes.

DELIMITATIONS

The subjects of this study are restricted to two Edmonton high schools: Ross Sheppard and Strathcona Composite High Schools. All students registered in the matriculation program were used except those with incomplete grade IX or grade X records. All pupils in the study were 1957 Alberta junior high school graduates. Their marks

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[1] J. F. Rummel, An Introduction to Research Procedures in Education. New York: Harper & Brothers, 1958. pp. 413.

are those obtained on Department of Education examinations in June 1957. These are reported as stanine scores. Test scores on the following subjects are used in this study:

Grade IX	Grade X
Reading	Language 10
Language	Literature 10
Social Studies	Social Studies 10
Literature	Science 10
Science	Mathematics 10
Mathematics	Physical Education 10
Total[1]	Health and Personal Development 10
	Electives [2]

BASIC ASSUMPTIONS

The following assumptions were made in this study:

(1) Grouping pupils of homogeneous ability provides an opportunity for better teaching. It should be noted here however, that it is not the purpose of this study to prove any superiority for homogeneous grouping. This assumption is based on the results established in the research literature.

(2) Teachers in both schools are comparable in ability and qualifications.

(3) It can not be assumed that the curriculum in each course

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[1] Total refers to the aggregate of the stanine scores received by the student.

[2] Electives include the many subjects offered the grade X pupils to complete their program. The selection is so diversified that the average (mean) mark was calculated and reported under one heading: Electives.

is the same in each school other than being within the limits of the Course of Studies. If the advantages of homogeneous grouping are to be achieved, and it is an assumption of this study that they were, the curriculum of each class consisting of homogeneously grouped pupils would differ. The low-ranked classes would receive only the core of each course while the top-ranked classes would receive an enriched curriculum.

HYPOTHESIS

Mitchell feels that grouping "is a powerful device for easier teaching and for better learning"[1] and will result in higher final grades. The hypothesis of this study is that homogeneously grouped students will get higher marks than students of comparable ability who are not so grouped. However, there is some doubt whether all pupils benefit equally. A sub hypothesis of this study is that the lower-ranked pupils within homogeneous classes of high ability will receive lower final marks than they would if they had been placed in classes of heterogeneous ability. Similarly, teacher rating of top-ranked pupils in homogeneous classes of low ability will be higher than if the same pupils had been placed in classes of heterogeneous ability.

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[1] Omar C. Mitchell, "Groping and Grouping," The American School Board Journal, 138: 21-3 April, 1959. p. 22.

SUMMARY OF PROCEDURE

The remainder of this study will be presented as follows: Chapter II will be devoted to a study of related literature and it will be divided into two sections: A review of literature on the classification of students into homogeneous or heterogeneous classes and the grading of students by their teachers. The experimental design will be described in Chapter III while the analysis of data will be discussed in Chapter IV. The conclusions and implications made in the study will be summarized in Chapter V. Much of the data used in this study is found on charts and tables. Examples of these will be included in the Appendix.

CHAPTER II

REVIEW OF THE LITERATURE

A Brief Review of Literature About the Homogeneous Grouping of Students

The most important outcome of formal education today, when we look to the great challenge of tomorrow, is the development of attitudes and methods of work which will cause the individual to continue his education so that he will at all times bring the tools of the educated man to bear on his present problems. School administrators and educators are becoming increasingly aware of the need of promoting a dynamic policy of pupil placement and teacher direction to instil in each pupil the desire to work to his or her maximum capacity. The Senior High School Handbook states that: "The prime aim of the school is to assist each Alberta youth in his growth towards self-realization."[1] The desire to help pupils achieve this goal has resulted in various organizational techniques by school administrators to encourage complete development of individual capacities.

A trend in high school administration is the acceptance of homogeneous grouping to facilitate teaching, to stimulate the superior students, and to allow for remedial work in those areas where it is

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[1] Senior High School Handbook, 1959-60 Province of Alberta. Department of Education, 1959. p. 5

required. Some Edmonton high schools have attempted forms of achievement grouping while one, to be included in this study, continues to place students heterogeneously. Thus, two contradictory philosophies are supported in the same school system: (1) That homogeneous grouping is advantageous to the pupil who is placed within a superior learning situation, and to the teacher who is permitted to teach to a narrower range of abilities. (2) That heterogeneous grouping is more democratic, is more natural to daily living, and permits a more normal social development.

A comparison of grading practices and achievement standards within the two administrative systems can be introduced best by a brief summary of some of the existing literature on grouping.

Since the 1920's when the testing movement was at its height, many instruments have been developed to measure individual differences in intelligence, scholastic aptitude, reading, mathematical ability and other school subjects. These have been used individually or in combinations to place pupils in classes best suited to their abilities and requirements. In the United States, "by 1947, fifty-three per cent of city systems had some form of ability grouping and fifty-eight per cent had special remedial groups."[1] "One plan has been ability grouping in which students are sectioned according to ability, using criteria such as I. Q., reading level, or marks given by the class

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[1] H. C. Welke, & D. H. Bragg, "Study in Ability Grouping" National Association of Secondary School Principals Bulletin. 42: 85-91, November, 1958. p. 86.

room teacher."[1] The author of the above statement goes on to state that:

> Today we know there is really no such thing as a homogeneous group. The extent of heterogeneity may be reduced by the careful use of multiple criteria, but there still would remain a wide diversity of interests and abilities that cannot be measured by the screening devices we have today.[2]

She expresses further opposition to homogeneous groups because they are undemocratic and unnatural to our social structure. Conant contradicts this argument when he states that: "the alleged development of democratic spirit by mixing different types together I believe to be largely an illusion, and the academic disadvantages are great."[3] He goes on to state that "some degree of grouping in terms of ability in English and History classes is in the best interests of all concerned."[4] He also suggests that science, mathematics and foreign languages could be included in the grouping device. A comparable plan has been devised and is presently in operation in some Edmonton high schools.

Wrightstone[5] is mildly in favor of grouping but implies that

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[1] E. W. Cummings, "Grouping: Homogeneous or Heterogeneous" Educational Administration and Supervision, 44: 19-26 January, 1958. p. 19.

[2] Ibid., p. 19

[3] J. B. Conant, "Some Problems of the American High School," Phi Delta Kappan, 40: 50-55. November, 1958. p. 51

[4] J. B. Conant, "The Public High School and the National Interest," National Association of Secondary School Principals' Bulletins, 42: 343-356. April, 1958. p. 346.

[5] J. Wayne Wrightstone, "What Research Says About Class Organization," National Education Association Journal, 46: 254-5. April, 1957.

the advantages are not noticeably general. Woodring is much stronger in his support of ability grouping when he states that: "The purpose of ability grouping--and its probable result is not to develop such a group, but rather to provide better learning situations for the fast and slow learners alike."[1] In an interesting study on the effectiveness of ability grouping French[2] found that bright children do better in high-ability classes and that slow children also do better in high-ability classes. This would indicate that ability grouping is helpful to bright children, but harmful to most of the slow children, a finding that seems to confirm the feelings of parents. The parents of bright children are usually delighted to have their children in fast groups, while the parents of slow children often complain that ability grouping is unfair and undemocratic.

On the contrary a recent summary of research on homogeneous grouping was made by Otto.[3] He concluded that the evidence slightly favors ability grouping, particularly where adaptations of standards, materials, and methods are met. The evidence he says, indicates greatest relative effectiveness for dull children, next greatest for average children, and the least (frequently harmful) for bright children.

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[1] P. Woodring, "Ability Grouping: Segregation and the Intellectual Elite," School and Society, 87: 164-5, April, 1959. p. 165.

[2] John W. French, Evidence from School Records on the Effectiveness of Ability Grouping. Princeton, New Jersey: Educational Testing Service. March, 1959. p. 17.

[3] H. J. Otto, "Homogeneous Grouping," Encyclopedia of Educational Research. New York: The MacMillan Co., 1950. 376-378.

In partial contradiction of Otto,[1] writers report that there is evidence to indicate that separate, homogeneous classes for gifted children result in greater achievement. Miles[2] stated that: "The experimental work with gifted children in which segregated are compared with non-segregated groups seems to point to more favorable progress as compared with the latter." She qualifies this statement by a comment that studies are too few to be completely convincing.

Vernon feels that classes must be grouped according to ability because: "there must be some restriction of their heterogeneity, otherwise the educational process becomes inefficient and frustrating to the students as well as the teachers."[3] This conclusion is supported in Hoover's statement that: "Two harmful practices are eliminated by ability grouping: trying to teach the average students and judging students on a competitive basis regardless of ability to do school work."[4]

Reeve[5] believes that each child's ability should be developed to the fullest. He feels that it is impossible to do this in our present schools, especially in the over-crowded situation that now exists. He does not believe that separate grouping harms the slow students. By

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[1] Loc. cit.

[2] C. C. Miles, "Gifted Children," Manual of Child Psychology. New York: John Wiley & Sons, 1954. p. 1032.

[3] Philip E. Vernon, "The Psychology of Individual Difference," The Education Digest, 24: 47-51, October, 1958. p. 47

[4] Kenneth Hoover, "An Experiment on Grouping Within the Classroom," California Journal of Secondary Education, 30: 326-331, October, 1955. p. 330.

[5] William D. Reeve, "The Problem of Varying Abilities Among Students in Mathematics," The Education Digest, 21: 40-43. May, 1956.

his own personal experience, he claims that: "all groups--slow, bright, and average benefited by being separated."[1] The superior students find no challenge and never develop their capacities if assigned only the average work. Slow students, if assigned work that is always beyond their abilities, learn little and may actually suffer personality damage if continually failed or given low grades.[2]

Two matched groups of gifted junior high school students were compared by Justman.[3] The experimental groups which were homogeneous in ability, were special rapid progress classes, while the control groups were in heterogeneous normal progress classes. The author concluded that segregation of gifted children in special progress classes is accompanied by academic achievement superior to that attained by matched pupils in normal progress classes with no detriment to social acceptance, interest, attitudes, and aspects of personality.

Gray & Hollingworth[4] compared the achievement of two groups of gifted children. One group was segregated into special classes, the other children were mixed among homogeneously composed classes. No statistically significant difference in achievement was found as a result of homogeneous grouping.

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[1] Ibid., p. 42

[2] H. C. Welke & D. H. Bragg, op. cit., p. 87

[3] J. Justman, "Academic Achievement of Intellectually Gifted Accelerants and Non-Accelerants in Junior High School" School Review, 62: 143-150, 1954.

[4] H. A. Gray, & L. S. Hollingworth, "The Achievement of Gifted Children Enrolled and not Enrolled in Special Opportunity Classes," Journal of Educational Research, 24: 1931, 255-261.

Few authors on this subject take into consideration the possibility that factors other than grouping could influence the achievement of pupils in these experiments. Attempts to control more than a very few of the possible variables affecting the learning situation and marking practices are scarce in these studies. In a recently completed review of the literature on experimental studies of homogeneous grouping Ekstrom states that:

> Considerable research has been reported under the general heading of homogeneous vs. heterogeneous grouping with no significant unanimity of findings. However, comparative studies of gifted students in general and special classes on all educational levels tend to be more uniform in denoting beneficial effects of the special classes on academic, personal and social growth.[1]

Literature on homogeneous grouping includes reports about schools which are organized on that basis. Lawson[2] describes a six track high school designed to meet the needs of all pupils while Lauchner, commenting on a similar program in a junior high school states that: "We believe this junior high school has given low-ability students the security needed, high-ability students the stimulation desired, and the rank and file boys and girls the setting appropriate for them."[3]

Harrower[4] supports these findings in her report on a three stream

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[1] R. B. Ekstrom, Experimental Studies of Homogeneous Grouping. Princeton, New Jersey: Educational Testing Service, April, 1959. p. 18.

[2] Anna E. Lawson, "Track School: Its Pupils Move on Six Ability-Paths," The Clearing House, 25: 515-20, May, 1951.

[3] A. H. Lauchner, "What Are Current Trends in Grouping Students For Effective Instruction?" National Association of Secondary School Principals Bulletin. 43: 6-9 April, 1959. p. 7.

[4] J. Jane Harrower, "Three Paths Through Hornell High School," The Clearing House, 25: 454, April, 1951.

high school which attempted to provide a suitable program for the academically-acclerated, the average and the slow-learner groups. The holding power of the school rose to approximately eighty-five per cent because the differentiated program recognized the varying abilities within the school and permitted each student to develop accordingly. These results are particularly startling when they are compared with the drop-out rate in Alberta as reported by Evenson and Smith who state that "only about 280 out of every 1,000 students enrolled in grade IX obtain a High School Diploma."[1]

Critics of homogeneity are equally outspoken. Their arguments are mainly confined to the social implications of homogeneous classification. Bettelheim[2] criticizes the use of intellectual ability as the basis for grouping because of the tendency to develop an intellectual caste system. He feels social position would have too great an influence on such grouping and advocates more careful study of the problem. Cummins[3] and Hamalainen[4] are also critical of homogeneous grouping. They feel that students placed into such groups lose the opportunity for the normal social development required when they take their place in society.

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[1] A. B. Evenson, and D. E. Smith, "A Study of Matriculation in Alberta," The Alberta Journal of Educational Research, 3: No. 2, June, 1957. p. 63.

[2] B. Bettelheim, "Segregation: New Style," School Review, 66: 251-72, September, 1958.

[3] E. W. Cummins, op. cit., 1958.

[4] Arthur E. Hamalainen, "Method of Grouping Pupils Should Provide Normal Social Situation," Nation's Schools, 45: 34-5, June, 1950.

Tonsor[1] thinks that the slow learner bitterly resents being placed in a special group. He claims that the slow learners want to be in normal classes and are stimulated by working with the gifted and that they profit from their work. This seems to be one of the strongest arguments against ability grouping, especially if teachers tend to "look down" on their less capable students. Cooke feels that "one of the problems that is difficult to solve with ability groups is to find teachers who are suitable and trained for these specialized groups."[2]

Willis lists six advantages of ability grouping:

(1) The teacher can plan a program with more scope and depth than for the average student.

(2) More individual learning activities are possible for the gifted learner.

(3) Gifted students tend to associate with each other.

(4) Intellectual challenge is more stimulating.

(5) More out-of-school projects are possible for the gifted group than for the heterogeneous class.

(6) Removing the gifted from a class encourages and gives more recognition to the other students.[3]

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[1] Charles A. Tonsor, "Must We Segregate?" National Association of Secondary-School Principals Bulletin, 37: 75-77, November, 1953.

[2] Edward W. Cooke, "Ability Grouping," National Association of Secondary-School Principals Bulletin, 36: 79-83, January, 1952, p. 83.

[3] Benjamin C. Willis, Report on the Program for the Gifted Child to the Chicago Board of Education, Chicago: Chicago Teachers College, 1957, p. 40.

He also lists some of the main arguments against ability grouping:

(1) Gifted students may develop snobbery and undemocratic attitudes.

(2) Superior students may become impatient with the less gifted because they are segregated from them and thus lose opportunity for training for leadership.

(3) The average student loses stimulation of ideas of the gifted.

(4) Superior ability is difficult to identify.

(5) Trait differences do not correlate with the general level of an individual's ability.[1]

Effects of Teacher Influence on the Grades Received by Their Pupils

It is logical to hold a change in educational practice good if that change has a reasonable chance of providing more meaningful and pertinent experiences in students than the practice that it is to displace can provide, or to regard a change as not worth the making if for any reason it does not promise appreciable enrichment of student experience. "A change to a particular kind of grouping or a change to the unselected class therefore must be justified by the prospects of better educational opportunities."[2] Rediger[3] could have continued that to be justified, the change must result in superior final grades, because in

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[1] Ibid, p. 41

[2] Joseph Rediger, "Shall We "Group" Students in Our High Schools?" American School Board Journal, 123: 29-30, November, 1951, p. 29.

[3] Loc. Cit.

Edmonton, as in all of Alberta "promotion into later years is now based on the students performance in the previous year," except in grades IX and XII when promotion is based on the Department of Education examinations.

Great care must be taken by teachers when assigning final marks to their pupils for the following reasons:

(1) Promotion into the succeeding grade depends on the teacher's assessment of progress.

(2) In some schools, pupil placement in classes depends on the previous year's achievement.

(3) Placement of transferred pupils and their ultimate success may depend on teacher assessment in the former school.

(4) Future livelihood may be directly influenced by the pupil's success or failure at school. This is measured in terms of teacher marks.

Marking practices are therefore extremely important. To be practical, grouping methods should result in superior educational opportunities for the student. This should be apparent in the reported final grades.

It is everywhere urged that the best means available should be employed to select the most promising young people and to prepare them for leadership. Education must become as meaningful and efficient as it is possible to make it. "Measurement of student development, attitudes and achievements and of the effects of the educational process

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[1] A. B. Evenson and D. E. Smith, "A Study of Matriculation in Alberta," The Alberta Journal of Educational Research, 4: 67-83, June, 1958, p. 67.

becomes a sine qua non if the individual and society are to be served."[1] Dr. Travers[2] has reviewed an exhaustive number of titles of research in an effort to summarize the work done in the field of evaluation. He exposes important gaps in our knowledge and outlines some of the immediate research required.

Much of the literature on marking or grading practices reveals the influence on teachers' marks of factors other than achievement. "Boys and girls are meeting success or failure in many of our nation's schools on the basis of the mark which a teacher gives to them in recognition of some unknown quantity of hidden ingredients.[3] Hadley adds that: "Much of the confusion about school marks can be traced to the fact that marks are used for so many different purposes and that no one definition covers all factors involved.[4] The grades received by pupils grouped into classes on the basis of homogeneous achievement should be relatively uniform. There is, however, the danger of the teacher's conscious or sub-conscious desire to rank each pupil in relation to other members of the class. This could result in a greater

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[1] W. T. Donahue, et al., The Measurement of Student Adjustment and Achievement. Ann Arbor: Bureau of Psychological Services, University of Michigan Press 1949. p. viii.

[2] Ibid., p. 150

[3] Ivan L. Russell, & Thalman, W. A. "Personality: Does It Influence Teachers' Marks?" Journal of Educational Research, 48: 561-4, April, 1955, p. 564.

[4] Trevor S. Hadley, "A School Mark--Fact or Fancy?" Educational Administration and Supervision, 40: 305-12, May, 1954, p. 305.

range or marks than should be expected because: "By the use of one device or another, teachers do express their judgements of the level of achievement exhibited by the various members of their classes."[1] Diederick,[2] Vaughn[3] and Baker[4] report experiments or studies on marking methods and their ramifications on promotion and teaching methods. Various systems or methods of marking are reported, but no reference directly pertinent or comparable to the problem undertaken in this study was discovered.

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[1] Robert S. Carter, "Non-Intellectual Variables Involved in Teachers' Marks," Journal of Educational Research, 47: 81-95, October, 1953, p. 92.

[2] Paul B. Diederick, "Pitfalls in the Measurement of Gains in Achievement," Education Digest, 21: 21-24, May, 1956.

[3] R. deLong Vaughn, "Marking By A Point System," American School Board Journal, 109: 29-30.

[4] Robert L. Baker, "Elementary School Marking Practices and Subsequent High School Achievement," Educational Administration and Supervision, 44: 158-66, May, 1958.

CHAPTER III

EXPERIMENTAL DESIGN

This study attempts to compare the final Grade X results of students grouped homogeneously in classes according to their achievement on the Grade IX Department of Education examinations with the results achieved by students who were not so grouped. However, problems of comparing the initial ability of the students entering the two high schools had to be met before any attempt could be made at a comparison of the final ratings received in Grade X.

The experimental design chosen was such that performances of students of like ability were compared on a class-to-class basis. This meant that the pupils from Strathcona Composite High School, where they were not grouped homogeneously, had to be, for purposes of comparison only, artificially grouped into classes on the basis of achievement on the Grade IX Department of Education examination results. These classes then paralleled those of Ross Sheppard Composite High School where the students had been initially grouped on the basis of grade nine achievement. The purpose of this artificial grouping, therefore, was to provide pairs of classes of equivalent initial ability.

SAMPLE

There were two specific reasons for selecting the two Edmonton Public High Schools chosen for this study. One school, Ross Sheppard Composite High School, classified the grade X pupils homogeneously on the basis of achievement on the Grade IX Department of Education examinations. The other school, Strathcona Composite High School, did not group pupils on this basis. In all, 248 grade X students from Ross Sheppard Composite High School and 197 grade X students from Strathcona Composite High School were used in this study. All students had the following qualifications: (1) They were enrolled in the grade X matriculation program in the 1957-58 school year. (2) They had written the grade IX Department of Education examinations in June 1957. (3) During the previous year each had been enrolled in a junior high school operated by the Edmonton Public School Board.

STUDY VARIABLES

The data were taken from the cumulative records [1] of the students used in this study. Additional information came from the administrative records of the high school concerned. [2]

Eight grade IX variables were used in this study. These were

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[1] Cumulative Records: a record of the pupil's personal history in school bringing together pertinent and reliable factors concerning a pupil during his attendance in a school operated by the Edmonton Public School Board.

[2] The author wishes to thank the administration in each school for the cooperation shown in making the school records available for this study.

the stanine scores received by each pupil on the Grade IX Department of Education examinations in Reading, Social Studies, Language, Mathematics, Science and Literature, the aggregate stanine scores and the total score received on the School and College Ability Test, Level 3 (S.C.A.T. 3). [1] The latter was reported as a percentile score.

The grade X variables consisted of the marks received in the following grade X subjects: Language 10, Literature 10, Social Studies 10, Mathematics 10, Science 10, Physical Education 10, Health and Personal Development 10, and the Electives.

It is noted that 11 students took the first seven subjects listed above. These constitute the core of the matriculation program. Because of the wide variety of electives available to these students however, it was deemed advisable for purposes of this study to combine the scores obtained in these electives into a single grade X variable. This has been simply identified as Electives.

The above data were compiled on assembly data sheets, of which an example is provided in Appendix A. Also included were the students' code number, the students' class number (real or artificial) and the sex of the student. This data was then punched on I.B.M. cards [2] for analysis.

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[1] Cooperative School and College Ability Tests: Manual for Interpreting Scores. Princeton, New Jersey: Cooperative Test Division, Educational Testing Service, 1957.

[2] The author wishes to thank the Faculty Committee on Educational Research for the use of the I.B.M. equipment in the Education Building at the University of Alberta.

CRITERIA USED TO ARTIFICIALLY GROUP STUDENTS FROM HETEROGENEOUS ABILITY CLASSES INTO CLASSES PARALLEL TO THOSE COMPOSED OF HOMOGENEOUS ABILITY STUDENTS

Pupils taking the matriculation program in Ross Sheppard Composite High School had been grouped into nine grade X classes on the basis of achievement on the grade IX Department of Education examinations. Placement was based on the aggregate stanine score received by each pupil. Establishing artificial classes of students of homogeneous ability from Strathcona Composite High School to match the existing classes in Ross Sheppard Composite High School was achieved using the following criteria: (1) Each class was made approximately proportional in number to the corresponding class in Ross Sheppard Composite High School based on the ratio of pupils in each school. (197 from Strathcona Composite High School; 248 from Ross Sheppard Composite High School.) (2) The ratio of boys to girls in each class was made to conform as closely as possible to the ratio in the corresponding class in Ross Sheppard Composite High School. (3) The mean stanine score in each class was made as nearly equal as possible to the matching class in Ross Sheppard Composite High School. These data are summarized in Table II.

Each pair of matched classes was called a group, thus creating nine groups. A "group" means, therefore, a specific pair of classes; while "class" refers only to a class in the specific school.

TABLE II

COMPARISON OF ROSS SHEPPARD COMPOSITE HIGH SCHOOL CLASSES IN GRADE X WITH "ARTIFICIAL" CLASSES IN STRATHCONA COMPOSITE HIGH SCHOOL

	Ross Sheppard				Strathcona			
Class No.	N.	Boys	Girls	Mean Aggregate Stanine	N.	Boys	Girls	Mean Aggregate Stanine
1.	35	19	16	50.20	19	13	6	50.11
2.	33	17	16	46.06	26	11	15	45.65
3.	31	19	12	39.77	25	15	10	39.92
4.	28	--	28	39.07	23	12	11	39.30
5.	30	21	9	35.70	25	18	7	35.44
6.	29	19	10	33.14	24	17	7	33.33
7.	18	9	9	31.56	17	9	8	31.06
8.	28	9	9	29.57	25	18	7	29.44
9.	16	9	7	25.38	13	7	6	26.08
Total	248	132	116	38.41	197	120	77	37.65

Two deviations from the criteria used for dividing the students from Strathcona Composite High School into "artificial" classes were found necessary in Classes 1 and 4. There were not enough high-achievement pupils entering Strathcona Composite High School to complete a class of twenty-eight pupils and still retain a sufficiently high mean standing of aggregate stanine score comparable to Class 1 from Ross Sheppard Composite High School. Therefore, Class 1, the top-ranked class, was smaller than the number required to maintain the correct proportion.

Class 4 from Ross Sheppard Composite High School was composed entirely of girls. Because there were proportionally fewer girls in the entire Strathcona sample, the creation of an all-girl artificial class

would have further distorted the ratio of boys and girls in the other classes. Therefore, eleven girls and twelve boys were assigned to this "artificial" class in spite of the corresponding class being composed entirely of girls.

TESTING THE HYPOTHESES

The study design depends upon two basic sets of data. First, the grade IX Department of Education examination results and second, the teacher assigned final grade X marks.

The grade IX results were used to compare the initial ability of the pupils entering the two high schools. School means and variability in the grade IX results were analyzed for significant differences to determine whether the initial mean ability of all pupils entering each school was comparable.

Before proceeding with further analysis of data, it was necessary to compare the pairs of classes in each group for equivalence. The hypothesis that pairs of classes were equivalent was tested using the conventional "t" test for mean differences and the "F" test for differences in variability.

The grade X marks were used to test the major hypothesis. This hypothesis assumed that students would be better taught if they were grouped homogeneously, and this would be indicated by higher marks assigned to these students by their teachers.

Comparisons were made between the total marks assigned in each school, and between the marks assigned to classes in each group, again using the "t" test for mean differences and the "F" tests for variability

differences. It should again be noted that the comparison of classes in each group is actually a comparison of the achievement of pupils who were grouped homogeneously with students of equivalent ability who were not so grouped.

Because it is necessary that teachers assign the final grades to their grade X students, the hypothesis is suggested that teachers who are inclined to rank students in order of achievement might, in effect, ignore the principle of homogeneity of pupils within the class. Such ranking could produce a greater variability of marks than might be expected, with the result that some pupils would receive lower marks than they would have received had they been registered in classes of heterogeneous ability. This hypothesis was tested using the analysis of variance technique.

Class means were analyzed to test the hypothesis that teachers were aware of the expected achievement level of each class and marked their pupils in relation to the performance of the entire student body, rather than the performance of the individual class. This latter statement actually presents the opposite hypothesis to that stated above. As before, the analysis of variance technique was used to test the hypothesis.

The results of the testing of the hypotheses stated above are reported in the next chapter.

CHAPTER IV

ANALYSIS OF DATA

Treatment of the data discussed in Chapter III involved three major issues: (1) Were pupils in the two schools comparable in initial ability as judged by their performance on the grade IX Department of Education examinations? (2) How did the final grade X marks compare between schools, and between specific groups in the schools? (3) How did the marks of each class compare with those of the other classes within the same school?

I. COMPARISON OF THE INITIAL ABILITY OF STUDENTS IN BOTH SCHOOLS

(a) Total Group.

The hypothesis tested here assumed there was no significant difference between the initial ability of pupils entering Strathcona and Ross Sheppard Composite High Schools. This hypothesis was tested by comparing the performance of each group of pupils on the grade IX Department of Education examinations.

The analysis of data confirming the above hypothesis is presented in Table III. No significant differences were found between the mean performances of each school's students on the eight grade IX variables examined.

TABLE III

COMPARISON OF TOTAL GRADE IX ACHIEVEMENT OF PUPILS ENTERING THE GRADE X MATRICULATION PROGRAM AT ROSS SHEPPARD AND STRATHCONA COMPOSITE HIGH SCHOOLS IN THE FALL OF 1957

	Ross Sheppard			Strathcona			Mean Difference		Analysis of Variance	
Grade IX Variable	N.	Mean	S.D.	N.	Mean	S.D.	"t"	test	"F"	test
Reading (a)	248	6.6331	1.5908	197	6.3604	1.595	1.7905	N.S.D.	1.0058	N.S.D.
Social Studies (a)	248	6.4919	1.5579	197	6.3100	1.5709	1.2184	N.S.D.	1.0166	N.S.D.
Language (a)	248	6.2782	1.5629	197	6.0863	1.3396	1.3956	N.S.D.	1.3612	5%(RS)(d)
Mathematics (a)	248	6.2782	1.6082	197	6.3096	1.5349	.1582	N.S.D.	1.0978	N.S.D.
Science (a)	248	6.3871	1.6590	197	6.4518	1.4084	.4444	N.S.D.	1.3880	5%(SC)(d)
Literature (a)	248	6.3427	1.7155	197	6.1320	1.6838	1.2990	N.S.D.	1.0379	N.S.D.
S.C.A.T. (b)	248	68.532	20.020	197	67.013	20.855	.7762	N.S.D.	1.0855	N.S.D.
Stanine Aggregate(c)	248	38.41	7.8030	197	37.65	7.6175	1.1959	N.S.D.	1.0486	N.S.D.

(a) Results in these variables are reported in stanines.

(b) S.C.A.T. are reported as percentile rank.

(c) Stanine Aggregate is reported as the sum of variables 1 to 6.

(d) School with larger standard deviations.

Significant differences in variability of marks between the two groups were found at the five per cent level of confidence in Grade IX Language and Science. In either case, the actual difference in variability was less than a quarter of a stanine. This was not considered of significant magnitude to refute acceptance of the hypothesis.

Therefore, it was concluded for purposes of this study, that there were no differences in the initial ability of students entering the two high schools.

(b) Comparison of Paired Classes

This analysis represented a further extension of the hypothesis stated above in section (a). The hypothesis tested here is that there were no significant differences in mean performance between each of the nine pairs of matched classes for each of the eight grade IX variables used to evaluate the initial ability of the students. This data is presented in Table IV.

Significant mean differences were found only in Group 8 which was a low ability group. Significant differences at the one per cent level of confidence were found in Reading and Literature favoring Ross Sheppard's Group 8, and in Mathematics favoring Strathcona's Group 8. No other significant differences were found.

Therefore, it was concluded, that for the purposes of this study, the hypothesis stated above was accepted. There were no significant differences in initial ability between each pair of classes of the nine groups. In Group 8 where three (of a possible eight) significant differences were found, the contradictory direction of these differences

TABLE IV

SUMMARY OF MEANS, STANDARD DEVIATIONS, AND SIGNIFICANT MEAN DIFFERENCES OF GRADE IX VARIABLES OF PUPILS ENTERING THE MATRICULATION PROGRAM AT ROSS SHEPPARD AND STRATHCONA COMPOSITE HIGH SCHOOLS FOR EACH PAIR OF CLASSES

Grade IX Variable					S.C.A.T.			READING			LANGUAGE			MATHEMATICS		
Group	School	N	Girls	Boys	Mean	S.D.	Mean Dif.	Mean	S.D.	Mean Dif.	Mean	S.D.	Mean Dif.	Mean	S.D.	Mean Dif.
1	R.S.	35	16	19	91.26	18.46	NSD	8.37	.97	NSD	8.29	.77	NSD	8.46	.81	NSD
	Scona	19	6	13	95.16	3.99		8.26	.75		8.37	.64		8.21	1.2	
2	R.S.	33	16	17	89.76	8.27	NSD	7.76	1.19	NSD	7.30	1.02	NSD	7.36	.97	NSD
	Scona	26	15	11	91.23	8.44		7.88	1.75		7.27	.75		7.73	1.14	
3	R.S.	31	12	19	82.87	11.24	NSD	7.19	1.48	NSD	6.48	.91	NSD	6.71	.81	NSD
	Scona	25	10	15	83.80	11.79		6.80	1.17		6.40	.94		6.88	1.28	
4	R.S.	28	28	0	73.82	17.71	NSD	6.32	1.59	NSD	6.82	1.08	NSD	6.29	1.14	NSD
	Scona	23	11	12	81.39	14.26		6.74	1.1		6.26	1.15		6.48	.92	
5	R.S.	30	9	21	69.63	17.02	NSD	6.03	1.1	NSD	5.87	.93	NSD	5.73	.95	NSD
	Scona	25	7	18	66.00	17.02		5.56	1.24		5.72	1.11		5.72	1.00	
6	R.S.	29	10	19	72.69	16.35	NSD	6.21	1.31	NSD	5.69	1.02	NSD	6.07	1.11	NSD
	Scona	24	7	17	73.13	13.84		6.33	1.09		6.00	1.04		5.87	1.26	
7	R.S.	18	9	9	61.44	8.44	NSD	5.44	.92	NSD	5.22	1.19	NSD	5.44	1.10	NSD
	Scona	17	8	9	54.59	17.84		5.59	.58		5.24	1.03		5.24	.97	
8	R.S.	28	9	19	58.36	13.39	NSD	5.61	.88	1%(RS)	4.75	1.06	NSD	4.46	.89	1%(SC)
	Scona	25	7	18	51.56	18.28		4.80	1.13		4.56	1.17		5.48	.98	
9	R.S.	16	7	9	41.94	16.56	NSD	5.00	.94	NSD	4.13	1.03	NSD	3.94	1.02	NSD
	Scona	13	6	7	46.08	12.66		4.38	.95		4.38	1.17		4.23	1.05	

TABLE IV (continued)

SUMMARY OF MEANS, STANDARD DEVIATIONS, AND SIGNIFICANT MEAN DIFFERENCES OF GRADE IX VARIABLES OF PUPILS ENTERING THE MATRICULATION PROGRAM AT ROSS SHEPPARD AND STRATHCONA COMPOSITE HIGH SCHOOLS FOR EACH PAIR OF CLASSES

Grade IX Variable				SOCIAL STUDIES			SCIENCE			LITERATURE			AGGREGATE		
Group	School	N	Girls	Boys	Mean	S.D.	Mean Dif.	Mean	S.D.	Mean Dif.	Mean	S.D.	Mean Dif.	Mean	S.D.	Mean Dif.
1	R.S.	35	16	19	8.40	.80	NSD	8.40	.76	NSD	8.34	.85	NSD	50.20	1.52	NSD
	Scona	19	6	13	8.53	.71		8.11	.87		8.63	.60		50.11	2.60	
2	R.S.	33	16	17	7.91	.74	NSD	7.97	1.11	NSD	7.76	1.05	NSD	46.06	1.65	NSD
	Scona	26	15	11	7.69	1.08		7.65	.82		7.38	1.04		45.65	1.83	
3	R.S.	31	12	19	6.52	.81	NSD	6.45	.96	NSD	6.42	1.03	NSD	39.77	2.78	NSD
	Scona	25	10	15	6.36	1.16		6.88	1.21		6.60	.89		39.92	2.46	
4	R.S.	28	28	0	6.71	.83	NSD	6.39	1.13	NSD	6.54	1.41	NSD	39.07	3.91	NSD
	Scona	23	11	12	6.74	1.18		6.57	.84		6.52	1.11		39.30	4.03	
5	R.S.	30	9	21	6.23	1.14	NSD	5.90	1.14	NSD	5.93	1.36	NSD	35.70	4.19	NSD
	Scona	25	7	18	6.36	.97		6.28	1.11		5.80	.98		35.44	4.11	
6	R.S.	29	10	19	6.31	.42	NSD	6.38	1.06	NSD	5.48	1.32	NSD	33.14	3.26	NSD
	Scona	24	7	17	5.87	1.04		6.50	1.26		5.75	1.59		33.33	3.57	
7	R.S.	18	9	9	5.50	.9	NSD	4.72	.81	NSD	5.22	1.59	NSD	31.56	4.24	NSD
	Scona	17	8	9	5.06	1.05		5.24	.85		5.29	1.72		31.06	3.71	
8	R.S.	28	9	19	4.57	1.06	NSD	4.96	.89	NSD	5.21	1.28	1%(RS)	29.57	1.77	NSD
	Scona	25	7	18	4.80	1.13		5.40	.98		4.52	1.06		29.44	3.27	
9	R.S.	16	7	9	4.31	.78	NSD	3.88	.97	NSD	4.13	.91	NSD	25.38	1.17	NSD
	Scona	13	6	7	4.69	.92		4.46	.85		3.92	.93		26.08	1.77	

provided no reason why the hypothesis should be rejected.

II COMPARABILITY OF FINAL GRADE X SCORES

(a) Comparison of Total Performance in Each School

Homogeneous grouping is reputed to afford the teacher a better opportunity to teach because of the narrower range of ability in each class. Improved instruction should mean greater academic gains which, in turn, should be reflected in higher marks. Therefore, the hypothesis tested in this section is that students from a school where pupils are grouped in homogeneous classes (Ross Sheppard) should have higher marks reported for the total group than a school where there is no homogeneous grouping of students (Strathcona).

The summary of the analysis of the data to test this hypothesis is presented in Table V.

Significant differences in mean final grades were reported for only two courses, Science 10 and Physical Education 10. In both courses, the differences were significant at the one per cent level of confidence. One of these significant differences, in Physical Education 10, favored Strathcona Composite High School where pupils were not grouped homogeneously. The other, in Science 10, favored Ross Sheppard Composite High School, where pupils were grouped homogeneously.

It is concluded that with the exception of Science 10, the hypothesis is rejected. In the two schools studied, the students who were grouped homogeneously did not receive significantly higher marks than the students who were not grouped on this basis.

TABLE V

COMPARISON OF TOTAL GRADE X ACHIEVEMENT OF MATRICULATION
PUPILS IN ROSS SHEPPARD (N = 248) AND STRATHCONA COMPOSITE HIGH SCHOOLS (N = 197)

GRADE X VARIABLE	ROSS SHEPPARD		STRATHCONA		SIGNIFICANCE OF DIFFERENCES	
	Mean	S.D.	Mean	S.D.	Means	Variance
Language 10	63.125	11.1490	62.280	10.3240	NSD	NSD
Social Studies 10	63.970	12.8675	61.420	12.3740	NSD	NSD
Mathematics 10	57.580	14.3540	58.425	15.6115	NSD	NSD
Science 10	66.370	11.5875	59.340	14.515	1%(RS)	1%(SC)
Literature 10	64.435	10.1610	63.400	12.265	NSD	1%(SC)
Physical Education 10	60.705	6.750	68.425	8.960	1%(SC)	1%(SC)
H. & P.D. 10	64.645	9.070	62.760	10.1565	NSD	1%(SC)
Electives	64.270	11.525	62.030	10.5250	NSD	NSD

The significant difference of marks received by pupils in the two schools in Science 10 and Physical Education 10 leads in each case to two possible explanations: First, Science 10 is being taught more effectively to students who are grouped homogeneously; while Physical Education 10 is better taught to students who are not so grouped. Second, the marking policy of the departments concerned in the two schools is basically different. Of the two possibilities, the difference between the Science 10 marks could best be explained on the basis of the influence of ability grouping. However, in Physical Education, academic ability is known to bear little relationship to physical skills. Therefore, the most reasonable explanation would seem to be that the teachers of Physical Education 10 in Strathcona Composite High School rate their pupils on a different weighting of criteria than do their Ross Sheppard counterparts.

(b) Comparison of Final Marks in Each Group

This section is a further testing of the hypothesis already tested in section (a) above. The hypothesis remains essentially the same as before, namely that students grouped homogeneously will get higher marks than comparable students who are not grouped according to ability. The summary of the data is presented in Table VI.

The higher achievement in Science 10 by pupils grouped homogeneously, which has already been reported in Table V, is again apparent in Table VI. The higher marks received in Physical Education 10 by pupils grouped heterogeneously is also readily evident. Significant

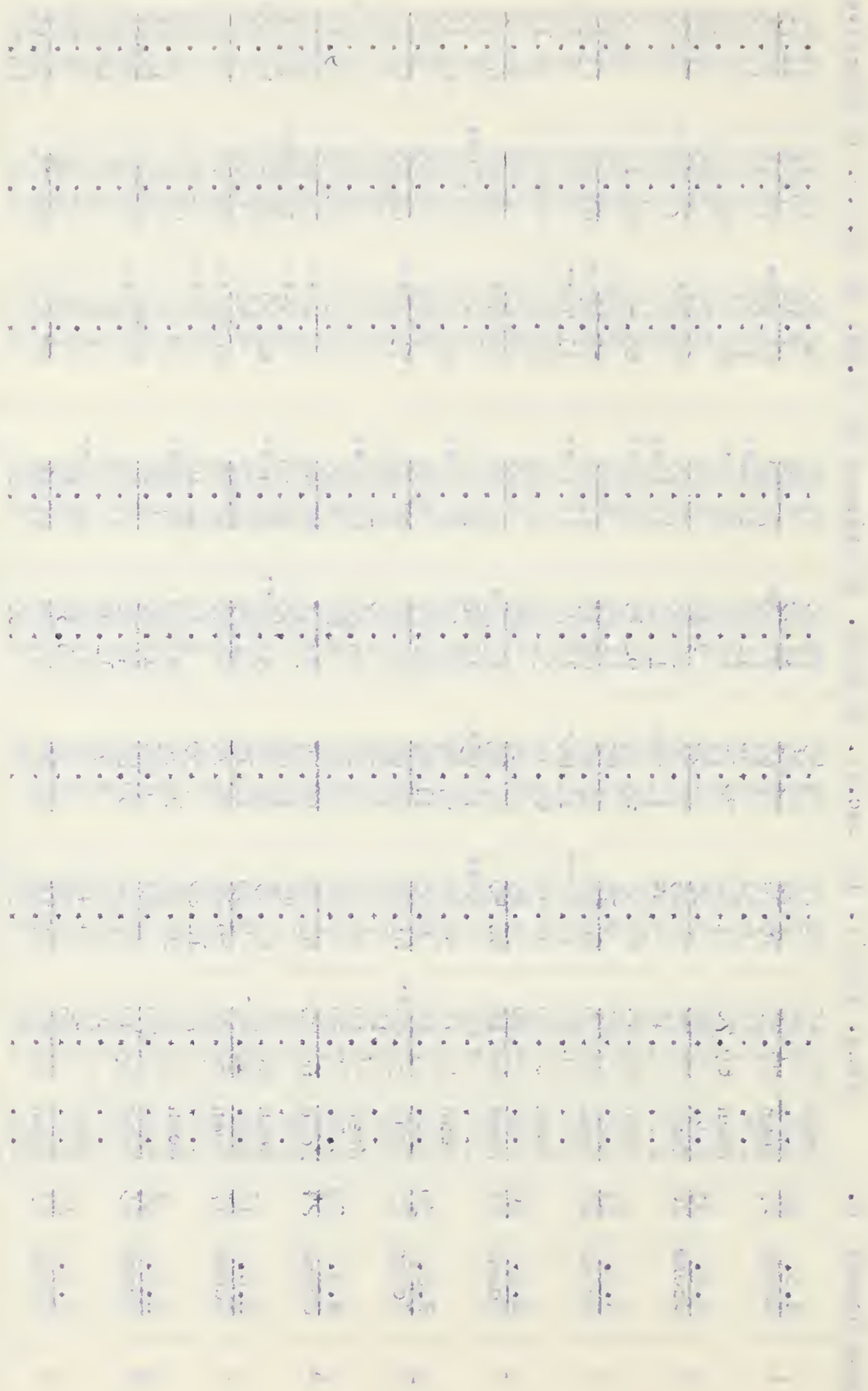
TABLE VI

COMPARISON OF MEAN ACHIEVEMENT OF GRADE X MATRICULATION PUPILS IN ROSS SHEPPARD AND STRATHCONA COMPOSITE HIGH SCHOOLS IN EACH OF THE GRADE X VARIABLES

Group	School	N.		Lang. 10	Lit. 10	Soc.St. 10	Math. 10	Science 10	P.Ed. 10	H.P.D. 10	Electives
1	R.S.	35	Mean	78.45	78.70	79.45	70.00	79.30	62.30	76.45	71.00
			S.D.	7.25	7.95	9.45	11.95	6.00	7.10	7.35	11.75
	Scona	19	Mean	77.30	76.70	77.65	77.65*	78.00	68.95**	77.35	72.75
			S.D.	7.15	6.50	8.80	11.95	12.60**	10.35*	8.80	11.20
2	R.S.	33	Mean	69.70	71.80	72.75	69.85	76.50*	64.40	66.70	67.90
			S.D.	5.20	5.35	6.50	9.10	4.50	7.75	5.85	9.80
	Scona	26	Mean	70.75	74.05	70.20	69.85	71.75	69.05*	74.25**	59.35
			S.D.	6.45	5.55	10.50**	10.30	11.10**	8.75	7.15	9.90
3	R.S.	31	Mean	67.45	64.35	65.00	62.75	70.30**	63.40	65.15	59.35
			S.D.	7.65	6.55	7.85	11.25	6.10	5.75	7.25	9.90
	Scona	25	Mean	63.20	66.60	62.40	62.75	61.20	70.40**	63.40	61.20
			S.D.	6.30	11.80**	11.60*	13.70	11.15**	11.75**	9.05	8.85
4	R.S.	28	Mean	63.95	63.40	64.10	51.25	65.55	62.30	65.00	65.15
			S.D.	4.90	4.65	8.15	9.85	7.65	7.75	5.00	10.75
	Scona	23	Mean	64.15	66.50	62.85	62.20*	62.20	69.55*	66.95	63.90
			S.D.	7.00	8.55**	12.05*	12.60	10.00	8.45	9.75**	8.95
5	R.S.	30	Mean	55.15	59.65	61.85	58.15	65.00**	60.42	60.35	62.35
			S.D.	7.15	6.55	11.60	10.75	8.35	7.65	8.65	9.70
	Scona	25	Mean	59.80**	61.20	61.60	55.80	57.20	71.20**	62.80	62.80
			S.D.	7.15	7.00	10.65	9.95	10.70	6.50	9.70	7.90
6	R.S.	29	Mean	58.10	58.80	59.65	56.20	66.20**	57.95	59.85	66.40*
			S.D.	7.20	7.60	7.75	9.60	8.35	5.15	5.80	9.75
	Scona	24	Mean	60.00	60.20	58.15	53.15	56.50	65.40**	62.70	60.65
			S.D.	7.35	7.45	10.00	9.75	10.35	8.55**	10.40**	10.25
7	R.S.	18	Mean	60.55	63.35	55.80	53.05**	56.40**	60.00	56.40	63.05**
			S.D.	10.40*	9.55	10.15	11.55	10.25	4.40	6.85	7.10
	Scona	17	Mean	56.20	56.20	54.70	44.40	48.85	66.45**	59.40	55.30
			S.D.	7.75	12.20	7.55	9.35	10.10	8.85**	9.05	7.95
8	R.S.	28	Mean	52.50	56.95	52.70	43.55	57.20**	54.65	52.30	56.95
			S.D.	8.60	7.85	8.50	11.40	9.00	6.80	8.50	10.10
	Scona	25	Mean	53.40	52.80	50.80	48.40	49.00	66.20**	57.00	57.00
			S.D.	8.10	8.25	9.95	11.95	8.70	7.10	9.70	12.10
9	R.S.	16	Mean	53.15	54.40	50.65	37.20	50.30**	58.75	51.55	54.05
			S.D.	5.85	4.90	9.35	6.35	8.35	7.20	6.05	7.55
	Scona	13	Mean	51.55	51.15	50.75	41.15	41.95	67.30**	55.75	56.15
			S.D.	6.90	5.25	7.85	8.60	9.60	6.40	6.10	10.60

** Significant at the 1% level of confidence

* Significant at the 5% level of confidence



differences are found for other variables but these do not appear as consistently as they do in the two subjects mentioned above.

Table VIII presents the summary of the tests of significant differences between class means for each of the eight grade X variables and for each of the nine pairs of matched classes reported in Table VI.

No significant differences between the means of each pair of classes was found for Social Studies 10 and Literature 10.

Significant differences favoring Strathcona for all nine groups were found for Physical Education 10. Differences in the mean mark for seven of the nine groups in Physical Education 10 were found to be significant at the one per cent level of confidence while the remaining two were at the five per cent level. These results support the findings previously noted in Table V, that the total school achievement in Physical Education 10 favored Strathcona Composite High School at the one per cent level of confidence.

In Science 10, significant differences at the one per cent level were found favoring Ross Sheppard Composite High School classes (3, 5, 6, 7 and 8). Two classes (2 and 9) were significantly different at the five per cent level while the remaining two classes (1 and 4) showed no significant difference. These differences supported the data reported earlier in Table V where the Science 10 marks in Ross Sheppard Composite High School were found to be significantly higher (one per cent level of confidence) than those of Strathcona Composite High School.

Only one group showed any significant difference in Language 10, favoring Class 5 from Strathcona Composite High School, at the one per

TABLE VII

SUMMARY OF THE SIGNIFICANT DIFFERENCES OF CLASS MEANS OF MARKS RECEIVED BY GRADE X PUPILS IN BOTH SCHOOLS

	High Initial Ability Group			Average Initial Ability Group			Low Initial Ability Group			TOTAL
CLASS	1	2	3	4	5	6	7	8	9	
GRADE X VARIABLES										
Language 10	NSD	NSD	NSD	NSD	1%(SC)	NSD	NSD	NSD	NSD	NSD
Social Studies 10	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD
Mathematics 10	5%(SC)	NSD	NSD	1%(SC)	NSD	NSD	1%(SC)	NSD	5%(SC)	NSD
Science 10	NSD	5%(RS)	1%(RS)	NSD	1%(RS)	1%(RS)	1%(RS)	1%(RS)	5%(RS)	1%(RS)
Literature 10	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD
Phy. Ed. 10	1%(SC)	5%(SC)	1%(SC)	5%(SC)	1%(SC)	1%(SC)	1%(SC)	1%(SC)	1%(SC)	1%(SC)
H. & P. D. 10	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD	5%(SC)	NSD
Electives	NSD	NSD	NSD	NSD	NSD	5%(RS)	1%(RS)	NSD	5%(SC)	NSD

cent level of confidence.

In Mathematics 10 four of the nine pairs of classes showed significant differences, all favoring Strathcona Composite High School. Two classes (4 and 7) were significant at the one per cent level, while the other two classes (1 and 9) were significant at the five per cent level.

In Health and Personal Development 10, one class (Group 2) favored Strathcona Composite High School at the one per cent level of confidence.

Two classes in Ross Sheppard Composite High School received significantly higher marks in the Electives, one each at the one per cent and five per cent levels of significance. One class from Strathcona Composite High School received superior grades significant at the five per cent level of confidence.

In summary, it seems reasonable to conclude that the hypothesis that pupils enrolled in homogeneous classes will receive higher marks may be rejected in all subjects except Science 10.

Because of their initial homogeneous placement, pupils in Ross Sheppard Composite High School should show the benefits of improved instruction accruing from such class organization. This should be particularly evident for students of high and low ability although the trend could also be expected to appear in the middle ability groups. This hypothesis was examined by dividing the nine pairs of classes in Table VII into three groups of above-average, average and below-average ability.

Analysis of Table VII indicates that pairs of classes in groups 1, 2 and 3 (the above-average group) at Ross Sheppard Composite High School performed at a significantly higher level in two instances, and were significantly lower in four others. In the average groups, (4, 5 and 6) there were three cases of significantly superior achievement reported for the students from Ross Sheppard Composite High School. Similar results were apparent between the paired classes of groups 7, 8 and 9 composing the below-average group. For this group there were four significant incidents of superior achievement by Ross Sheppard classes and seven of significantly lower achievement. Although somewhat inconclusive, these results do further discount the hypothesis that superior marks will be received by homogeneously grouped pupils.

The hypothesis was tested further by use of the Sign Test.[1] It was reasoned that if the hypothesis were true, mean marks from Ross Sheppard Composite High School should be consistently higher for each of the nine classes, even though the differences between the means of the paired classes of each group might not be statistically significant. A plus sign (+) was assigned to a class from Ross Sheppard Composite High School which achieved a higher mean in any grade X variable than the corresponding class from Strathcona Composite High School, and a minus sign (-) when the Strathcona class had the higher mean. In a case where the means were equal the tie was indicated with a zero (0). This analysis is presented in Table VIII.

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[1]Sidney Siegel, Nonparametric Statistics For the Behavorial Sciences. Toronto: McGraw-Hill Book Co. Inc., 1956. p. 68

Table VIII

SIGN TEST COMPARISON OF MEANS OF MATCHED CLASSES

	High Initial Ability			Average Initial Ability			Low Initial Ability			Favoring Ross. Shep.		Favoring 'Scona	
Grade X variable	1	2	3	4	5	6	7	8	9	Ratio	P.	Ratio	P
Language 10	+	-	+	-	-	-	+	-	+	4/9	.50	5/9	.748
Social Studies 10	+	+	+	+	+	+	+	+	-	8/9	.998*	1/9	.02
Mathematics 10	-	0	0	-	+	+	+	-	-	3/7	.500	4/7	.793
Science 10	+	+	+	+	+	+	+	+	+	9/9	1.000**	0/9	.002
Literature 10	+	-	-	-	-	-	+	+	+	4/9	.500	5/9	.746
Physical Education 10	-	-	-	-	-	-	-	-	-	1/9	.002	9/9	1.000**
H & PD 10	-	-	+	-	-	-	-	-	-	1/9	.02	8/9	.998*
Electives	-	+	-	+	-	+	+	-	-	4/9	.500	5/9	.746

* Significant at 5% level
** Significant at 1% level

The hypothesis that pupils grouped homogeneously in Ross Sheppard Composite High School will receive higher marks than pupils of equal ability in Strathcona Composite High School can be accepted only in Social Studies 10 at the five per cent level of confidence and in Science 10 at the one per cent level. On the other hand, the final marks assigned to students of Physical Education 10 and Health and Personal Development 10 at Strathcona Composite High School were consistently higher than those assigned at Ross Sheppard Composite High School, the former significant at the one per cent level and the latter at the five per cent level.

(c) Comparison of Variability of Marks in Each Group

Another indication of the effectiveness of instruction, can be found in the range of marks earned. If the instruction is more effective, variability of marks within the class might increase. This should be particularly evident in studies involving classes initially matched for ability and then taught by different methods of instruction. For this study then, a test of the improvement in instruction due to homogeneous grouping may be indicated by differences of variability between the paired classes.

The hypothesis to be tested in this section is that the marks of the students grouped homogeneously in Ross Sheppard Composite High School will display greater variability than those from Strathcona Composite High School where pupils are not grouped on this basis. The standard deviations reported in Table VI were tested for significance of differences in each subject for each pair of classes. The summary of the tests is reported in Table IX.

From the findings reported in Table IX it is possible to conclude, that contrary to the above hypothesis, homogeneously grouped pupils generally tend to get more homogeneous marks. Only one case of significantly greater variability of marks was found favoring Ross Sheppard Composite High School. This was in Language 10 for Group 7 at the five per cent level of significance. Thirteen incidents of significantly greater variability of marks were found favoring Strathcona Composite High School. These were scattered randomly. Two appeared in Social Studies 10, at the one per cent level of significance

TABLE IX

SUMMARY OF SIGNIFICANT DIFFERENCES IN VARIABILITY
OF MARKS IN NINE GROUPS

	High Initial Ability			Average Initial Ability			Low Initial Ability		
	1	2	3	4	5	6	7	8	9
GRADE X VARIABLE CLASS									
Language 10	NSD	NSD	NSD	NSD	NSD	NSD	5%(RS)	NSD	NSD
Social Studies 10	NSD	1%(SC)	5%(SC)	NSD	NSD	NSD	NSD	NSD	NSD
Mathematics 10	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD
Science 10	1%(SC)	1%(SC)	1%(SC)	NSD	NSD	NSD	NSD	NSD	NSD
Literature 10	NSD	NSD	1%(SC)	1%(SC)	NSD	NSD	NSD	NSD	NSD
Physical Education 10	5%(SC)	NSD	1%(SC)	NSD	NSD	1%(SC)	1%(SC)	NSD	NSD
H. & P. D. 10	NSD	NSD	NSD	1%(SC)	NSD	1%(SC)	NSD	NSD	NSD
Electives	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD	NSD

(Class 2 and at the five per cent level in Class 3). Three cases were found in Science 10 in Classes 1, 2 and 3, all at the one per cent level of significance. Two cases, both at the one per cent level of confidence were found in Classes 3 and 4 in Literature 10. Four classes from Strathcona Composite High School had significantly greater variability of assigned marks in Physical Education 10. These were Classes 3, 6, and 7 at the one per cent level of significance and Class 1 at the five per cent level. Similarly, Classes 4 and 6 showed greater variability at the one per cent level in Health and Personal Development 10.

Application of the Sign Test to differences in variability between pairs of classes further refutes the above hypothesis. Analysis of Table X reveals consistently greater variability of assigned marks in Strathcona Composite High School.

TABLE X

SIGN TEST COMPARISON OF VARIABILITY
OF MARKS RECEIVED BY MATCHED CLASSES

	High Initial Ability			Average Initial Ability			Low Initial Ability			Favoring Ross Shep.		Favoring Scona	
Grade X variable	1	2	3	4	5	6	7	8	9	Ratio	P.	Ratio	P.
Language 10	+	-	+	-	o	-	+	+	-	4/8	.637	4/8	.637
Social Studies 10	+	-	-	-	+	-	+	-	+	4/9	.50	5/9	.746
Mathematics 10	o	-	-	-	+	-	+	-	-	2/8	.145	6/8	.965*
Science 10	-	-	-	-	-	-	+	+	-	2/9	.090	7/9	.980*
Literature 10	+	-	-	-	-	+	-	-	-	2/9	.090	7/9	.980*
Physical Education 10	-	-	-	-	+	-	-	-	+	2/9	.090	7/9	.980*
H.&P. D. 10	-	-	-	-	-	-	-	-	-	0/9	.002	9/9	1.00 **
Electives	+	-	+	+	+	-	-	-	-	4/9	.500	5/9	.746

* Significant at 5% level
** Significant at 1% level

In fact, significantly greater variability between classes appeared in five of the eight grade X variables, all in favor of Strathcona Composite High School. These variables were Mathematics 10, Science 10, Literature 10, and Physical Education 10, all at the five per cent level of significance and in Health and Personal Development 10 at the one per cent level.

Comparison of Table X with Table VIII (Sign Test Comparison of Means of Matched Classes) reveals that although class means in Social Studies 10 and Science 10 were higher in Ross Sheppard Composite High School, variability of marks in these subjects was greater in the classes from Strathcona Composite High School. This means that pupils from Ross Sheppard Composite High School received more homogeneous marks within each class than did the pupils from Strathcona Composite High School. This was evident in all classes including those from Ross Sheppard Composite High School which had higher class means. Because class means and variability of marks were not consistently higher in favor of the homogeneously grouped pupils in Ross Sheppard Composite High School it is doubtful whether these pupils received superior instruction or whether their teachers recognized superior performance by assigning higher grades. Therefore, because teachers tend to give homogeneous marks to homogeneously grouped pupils, the hypothesis is rejected.

Further analysis of the greater variability of marks by heterogeneously grouped pupils suggests a strong possibility that some pupils are allowed to perform at a lower level of achievement

than could be expected from pupils of their ability. Homogeneously grouped pupils, on the other hand, appear to achieve results more commensurate with their ability, therefore resulting in homogeneous class marks. This could be a strong endorsation for classifying pupils homogeneously, namely, that more pupils may be motivated to achieve school grades commensurate with their ability.

III COMPARISON OF MARKS ACHIEVED BY CLASSES WITHIN THE SAME SCHOOL

A hypothesis of this study is that regardless of the mean ability of each class, teachers will rank students without carefully considering the narrower range of ability in each class and the relationship of the class with the other classes in the same grade. It is possible that there will be no difference in the reported performances of several homogeneously grouped classes regardless of their original level of achievement. In a school where pupils are not grouped homogeneously, superior ability students will as a group, receive higher marks than students of lesser ability. Analysis of variance was used to test this hypothesis for each school. A sample of this procedure is reported in Table XI and Table XII.

After significant "F" tests were applied, the data were further tested for homogeneity of variance using Bartlett's test.[1] Significance

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[1]Allen E. Edwards, Experimental Design in Psychological Research. New York: Rinehart & Company, Inc., p. 198.

TABLE XI

DISTRIBUTION OF FINAL MARKS IN HEALTH AND PERSONAL DEVELOPMENT 10
(ROSS SHEPPARD)

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95					
X^1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		N	ΣXI	ΣXI^2	$\bar{X}$
Class 1								1	2	8	8	11	2	2	1		35	395	4533	11.286
2							3	4	10	12	3	1					33	308	2920	9.333
3							4	8	9	7		2	1				31	280	2594	9.032
4							1	9	9	7	2						28	252	2296	9.000
5				1		5	6	6	5	4	3						30	242	2042	8.067
6						3	7	10	7	1	1						29	231	1879	7.966
7					2	3	6	3	3	1							18	131	987	7.278
8				3	5	8	5	5	1			1					28	181	1251	6.464
9				2	1	6	4	3									16	101	661	6.313
Total				6	8	25	36	49	46	40	17	15	3	2	1		248	2121	19163	8.552

TABLE XII

ANALYSIS OF VARIANCE FOR HEALTH AND PERSONAL DEVELOPMENT 10
FOR NINE CLASSES IN ROSS SHEPPARD COMPOSITE HIGH SCHOOL

I ANALYSIS OF VARIANCE

$$S.S.\ (t) = 19163 - \frac{(2121)^2}{248} = 1023.32$$

$$S.S.\ (g) = \frac{4533}{35} + \frac{2920}{33} + \ldots\ldots\frac{661}{16} - \frac{(2121)^2}{248} = 543.03$$

$$S.S.\ (w) = 1023.32 - 543.03 = 480.29$$

	S. S.	d. f.	Mean Square	F
Group	543.03	8	67.88	33.1
Within	480.29	239	2.01	
Total	1023.32	247		

"F" significant at the one per cent level of confidence

II BARTLETT'S TEST FOR HOMOGENEITY OF VARIANCE

$$Diff = \sum(n-1)\left[\frac{\log\sum x^2}{\sum(N-1)}\right] - \sum(n-1)(\log s^2)$$

$$= 239\ (\log \frac{480.29}{239}) - 62.225$$

$$= 14.181$$

$$x^2 = (2.303)(14.181) = 32.653$$

$$Correction = 1 + \left(\frac{1}{24}\right)\left(.3637 - \frac{1}{239}\right)$$

$$= 1.00017$$

$$Corrected\ x^2 = \frac{32.653}{1.00017} = 32.646$$

Significant at the one per cent level of significance

III TUKEY'S TEST FOR SIGNIFICANT GAP

(1), (2), (3,4), (5,6), (7), (8,9).

Significant gap was found between Class 1 and 2, 2 and 3, 4 and 5, 6 and 7, and 7 and 8.

of means was then analyzed using Tukey's Procedure.[1] This latter procedure was used for two purposes. First, it was used to determine if class mean differences could be responsible for the findings from the significant "F" Test. This was necessary because of the growing belief as stated by Cochrane and Cox[2] that the homogeneity of variance is not as critical a prerequisite for group comparisons as had been previously thought. The second purpose of this latter test was to rank the various class means in significant order.

The summary of the analysis of variance and tests of homogeneity of variance is reported in Table XIII.

TABLE XIII

SUMMARY OF ANALYSIS OF VARIANCE TESTING THE HYPOTHESIS THAT MARKS DO NOT DIFFER FROM CLASS TO CLASS WITHIN THE SCHOOL

Ross Sheppard			Strathcona	
"F" Test	Homogeneity of Variance	Subject	"F" Test	Homogeneity of Variance
1%	1%	Language 10	1%	NSD
1%	1%	Social Studies 10	1%	1%
1%	1%	Mathematics 10	1%	1%
1%	1%	Science 10	5%	NSD
1%	1%	Literature 10	1%	1%
1%	1%	Physical Education 10	NSD	---
1%	1%	Health and Personal Development 10	1%	5%
1%	5%	Electives	1%	5%

[1] Allen L. Edwards, Statistical Methods for the Behavorial Sciences. New York: Rinehart & Company Inc., 1956, p. 330-335.

[2] William G. Cochrane, and Gertrude M. Cox, Experimental Designs. New York: John Wiley and Sons, 1957. p. 91

From Table XIII it is noted first that a significant range of marks was evident in Ross Sheppard Composite High School in all grade X variables. Therefore, the hypothesis that all classes composed of pupils of homogeneous ability will receive equal mean marks is denied. Heterogeneously grouped pupils also received the expected range of marks, but with one exception. No significant variability of marks was found in Physical Education 10, which in the light of previous information is not an unexpected result.

Tukey's Procedure ranks classes in order of mean performance. Differences between adjacent class means were analyzed for significant psychometric distances or gaps. If the difference was significant at the five per cent level of confidence, or greater, each class mean was considered statistically different. Where significant gaps did not occur between class means the classes were considered as groups. Each group was separated from adjacent classes or groups by significant gaps.

Table XIV reports the rank order of class means which are identified by class numbers only. The actual means can be determined from Table VI. Where there were no significant differences in mean performance or gaps, between two or more classes, the minor differences between class means were ignored and the classes were arranged in groups according to Tukey's Procedure, in descending rank order. This procedure facilitates testing the next hypothesis.

The hypothesis to be tested using this data is that classes should be ranked in order according to their ability (i.e. the highest ranked students should get the highest marks.)

TABLE XIV

RANK ORDER OF CLASS MEANS AS ESTABLISHED BY TUKEY'S TEST FOR SIGNIFICANT GAP

Classes Ross Sheppard	Rank Order In Grade X Subjects Lang.10	Soc. St.10	Math. 10	Science 10	Lit.10	P.E.10	H.P.D.	Electives
1[a]	1 **.[b]	1 **	1	1 **	1 **	1	1 **	1
2	2 **	2 **	2 **	2 **	2 **	2	2	2 **
3	3 **	3	3 **	3 **	3	3	3	4
4	4 **	4	5	4	4	4 **	4 **	6 **
5	(7)[c] **	5	6	5	(7) **	5	5	5
6	6 **	6 **	7 **	6 **	5	7 **	6 **	7 **
7	(5) **	7 **	(4) **	7	6 **	6	7 **	(3) **
8	8	8	8 **	8 **	8 **	9 **	8	8 **
9	9	9	9	9	9	8	9	9
Strathcona								
1	1 **	1 **	1 **	1 **	1 **	1	1 **	1 **
2	2	2 **	2 **	2 **	2 **	2	2 **	2 **
3	3	3	3	3	3	3	4 **	3
4	4 **	4	5 **	4 **	4 **	4	3	4
5	5	5 **	4	5	5	5	5	5
6	6 **	6 **	6 **	6 **	6 **	6	6 **	6 **
7	7 **	7 **	8 **	7	7 **	7	7 **	7
8	8	8	7	8 **	8	8	8	8
9	9	9	9	9	9	9	9	9

(a) Class #1 is the class of highest ability (in its school) as determined by mean achievement in Grade IX. Class #2 is the class of second highest ability.

(b) When, according to Tukey's Procedure, mean differences between classes were significant, the psychometric distance or gap was represented by **. Class means which were not significantly different, and were not separated by ** have been recast in descending numerical order. For true rank order of means, reference is made to Table VI.

(c) Significantly out of rank order (i.e. more than one place out of order.)

Table XIV strongly supports the hypothesis that students ranked higher initially will receive higher marks. Mean standings of the top-ranked students from both schools found in Groups 1, 2 and 3 maintained the proper sequential order with two exceptions, one from each school. The exception from Strathcona was a simple exchange of position with an adjacent class. The only case among the top-ranked classes that was significantly out of order occurred in Ross Sheppard Composite High School in the Electives where the mean achievement appeared influenced by the particular electives taken by the pupils in the class.

Results comparable to those reported for the top-ranked classes were found in Groups 8 and 9 which are composed of the lowest ranked classes. Two cases appeared out of order and these were, as in the top-ranked classes, a simple exchange of position with the adjacent class above or below.

More class means appeared out of position from groups 4, 5, 6 and 7 than among the top and bottom ranked groups. In fact, a total of eighteen incidents were found where classes were out of rank order. The significant factor raised here, is that fourteen of the eighteen incidents of out-of-rank order were found among the classes from Ross Sheppard Composite High School. Furthermore, no incident of out-or-rank order from Strathcona Composite High School was more than an exchange of position with the adjacent class. Four cases of significant out-of-rank order (more than one step out of order) were found in the Ross Sheppard Composite High School data. These will be analyzed below.

Class 7 from Ross Sheppard Composite High School appeared significantly out of position in Language 10, having exhanged positions with class 5. A comparable situation existed in Literature 10 where Class 7 also replaced Class 5, forcing Classes 5 and 6 into the lower positions. The coincidence of the high mean achievement in Language 10 and Literature 10 by Class 7 could be due to the likely possibility that the same teacher taught both subjects. The higher position achieved by this class could be explained by better teaching, or less accurate grading than in other classes taking Language 10 and Literature 10 from other teachers.

A significant case of non-sequential order was found in Mathematics 10 where Class 4 from Ross Sheppard Composite High School was down four steps in sequence. Upon analysis of Table IV it was noted that this class was composed entirely of girls. This significant out of rank position could then be explained on the established phenomenon that girls' achievement in mathematics is generally lower than boys'.

The remaining significant occurrence of out of sequence order was found in the Electives. These results reflect achievement in a diversity of subjects, and were therefore influenced by the difficulty of the subject or subjects taken and the philosophy or marking the Electives as opposed to the matriculation core subjects. An example is cited in Class 3 (from Ross Sheppard Composite High School.) This class appeared five steps below its expected position. The main elective taken here was Typing 10. The results could reflect a reluctance on the part of the teacher to mark an above-average

group high enough. However, a more likely conclusion could be based on the fact that typing is essentially a physical skill and therefore marks received by pupils are not necessarily commensurate with academic aptitude.

A significant finding occurred upon analysis of the means achieved by each class from Strathcona Composite High School in Physical Education 10. No significant gaps were found between the class means. This implied that regardless of initial academicability, all classes received similar marks. These results support the previously cited assumption that physical skills are not correlated to academic achievement.

In summary, Tukey's Test to rank means, supported the hypothesis that higher ability pupils get higher marks. Furthermore, because more classes from Ross Sheppard Composite High School appeared out of their proper numerical order, and showed a greater range of displacement, the conclusion may be reached that pupils who are grouped homogeneously are less likely to receive marks commensurate with initial ability than those pupils who were not initially grouped into classes on the basis of academic ability.

IV SUMMARY OF FINDINGS

The analysis of total achievement on Grade IX Department of Education examinations by pupils entering each school indicated comparable ability. Classes formed when pupils from Strathcona Composite High School were artificially grouped into homogeneous ability classes

proved comparable to the matched classes from Ross Sheppard Composite High School. With three exceptions, all appearing in one group (Group 8), no significant mean differences were found between classes in each of the grade IX variables.

Significant mean differences were found to favor the pupils from Ross Sheppard Composite High School in the final results they received in Science 10. Strathcona Composite High School pupils received significantly higher marks in Physical Education 10. The Sign Test supported the above findings but also indicated consistently superior mean scores in Social Studies 10 favoring Ross Sheppard Composite High School classes and in Health and Personal Development 10 favoring the heterogeneously grouped pupils in Strathcona Composite High School

When the data were tested for significant variance to support the hypothesis that more appropriate teaching as a result of homogeneous grouping of pupils should result in a greater range of marks it was revealed that only one case of significantly greater variability was found among the classes from Ross Sheppard Composite High School. Significant variability of marks was evident in four classes of Physical Education 10 and two classes of Social Studies 10 favoring Strathcona Composite High School. The latter case is particularly significant because class means in Social Studies 10 favored Ross Sheppard Composite High School (Table VIII). This suggests that the excess variability was caused by some very low marks in Social Studies 10 in Strathcona Composite High School. No consistent significance

of variance occurred in the other subjects; so the above hypothesis was rejected.

The rank position of class means was used to test the hypothesis that top-ranked pupils will receive top marks regardless of the type of class or school program to which they are assigned. Analysis of the ranking of class means supported the hypothesis in Strathcona Composite High School where pupils were not grouped into homogeneous ability classes. The same was only generally true in Ross Sheppard Composite High School. A number of cases of displacement of rank order suggested the possibility of intra-class bias, or, more effective teaching, to some homogeneously grouped students. Downward displacement of means may have resulted from the reluctance of teachers to change their grading techniques in spite of teaching homogeneously grouped pupils with the result that the pupils in some classes received lower marks than they would have, had they been grouped heterogeneously. Better teaching, resulting from a narrower range of ability in each class, could explain the incidents where means were higher than expected.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

The major hypothesis of this study was that students grouped homogeneously according to ability will receive higher marks than those who are not so grouped.

Other, or sub-hypotheses were as follows:

(1) The final marks received by homogeneously grouped pupils will be more variable than those received by pupils of equal ability who took their instruction as members of classes of heterogeneous ability.

(2) Lower-ranked pupils within classes of high homogeneous ability will receive lower final marks than if they had been registered in classes of heterogeneous ability.

(3) When students are grouped homogeneously according to ability, high-ranking classes will receive higher mean scores than low-ranking classes.

(4) Teachers who instruct the high-ranking classes may not be sufficiently sensitive to the high ability to these classes. As a result, members of these classes might receive a wider range of marks than they would have received if they had been members of classes composed of pupils of heterogeneous ability. It follows, therefore,

these classes would be lower. Similarly, teachers who instruct classes of low ability tend to assign marks resulting in higher class means.

Analysis of the results received in grade nine by the pupils used in this study indicated that those entering the two high schools were comparable in achievement as measured by the Grade IX Department of Education examinations. The comparison of matched classes in each grade nine variable revealed, with a few minor exceptions, similar class means and standard deviations.

The major hypothesis that students grouped homogeneously receive higher marks than those not so grouped was not in general supported by the results in this study. By subjects, the hypothesis was supported in Science 10 and Social Studies 10, and rejected in Physical Education 10 and Health and Personal Development 10. No significant conclusion could be reached from the analysis of the data on Language 10, Mathematics 10, Literature 10, and the Electives. In general, therefore, these results suggest the possibility that pupils grouped homogeneously achieve higher results in some academic subjects but not in the non-academic subjects.

Contrary to sub-hypothesis (1), the conclusion reached in this study was that teachers tend to give less variable grades to pupils who are homogeneously grouped on the basis of previous achievement. Furthermore, the fact that marks received by pupils grouped heterogeneously are more variable suggests a strong possibility, particularly where class means are low, that some of these students are not receiving marks commensurate with their ability. One possible explanation

could be that some pupils are not motivated to achieve as well when they are members of classes composed of pupils of heterogeneous abilities than if they had been members of homogeneous ability classes.

The fact that heterogeneously grouped students receive more variable marks than students of equal ability who were grouped homogeneously also rejects sub-hypothesis (2). In most cases, therefore, the teachers apparently considered the homogeneity of abilities in each class and assigned the final grades accordingly.

Support for sub-hypothesis (3) that top-ranked classes would receive the highest mean marks was found in the consistently high position and order of the means of the top three classes from both schools. This hypothesis was also supported by the means of the middle and lower ability classes from Strathcona Composite High School. However, the hypothesis was not as strongly supported by the means of the middle and lower classes in Ross Sheppard Composite High School. A number of significant inter-class differences and deviations from expected rank position were found. These deviations might result from teacher bias or influence, or reflect the effects of more appropriate teaching to some classes.

Sub-hypothesis (4) may also be rejected by the conclusion that homogeneously grouped pupils receive less varied marks. Members of high ranking and low ranking classes did not receive a greater variety of marks than heterogeneously grouped pupils of comparable ability. Therefore, it may be concluded that deviations from the expected rank order of class means were not caused by the range of marks received

by homogeneously grouped pupils.

In summary, although there was some evidence that pupils who were grouped homogeneously, did receive superior marks, analysis of the data proved inconclusive. Support for the hypothesis was limited, suggesting the following possibilities: either the teaching to classes of homogeneous ability was not being adjusted to class needs, or teachers did not rate some of their pupils high enough.

IMPLICATIONS OF THE STUDY

The assumption that classification of pupils on the basis of homogeneous ability would result in superior achievement by the pupils was not supported in this study. In fact, little significant difference was found between the mean achievement of pupils grouped homogeneously in one school with that of pupils of comparable ability who were not so grouped in the other school.

The purpose of this study was not to prove the advantages or disadvantages of such grouping. The purpose was rather to compare the reported marks of pupils who were grouped homogeneously with those of pupils who were not so grouped. The fact that significantly higher ratings were not reported for pupils grouped homogeneously suggests a number of implications.

It is possible that some teachers require assistance to help them understand the varied needs of classes composed of pupils of homogeneous ability. Conformity to the same methods of instruction for all classes destroys, or at least, takes no advantage of the

possibilities of homogeneous grouping. In-service training may be required to help teachers provide a program of instruction suited to the ability of their classes. To help teachers understand the needs of homogeneously grouped students, especially those who are members of high ranking or low ranking classes, department heads and administrators must become aware of the needs of each group of pupils. Administrators must also be aware of the need of careful assignment of teaching duties to those teachers who would be best suited to teach certain levels of ability.

Grading practices should be under continual supervision and possible revision to ensure fair results to those pupils who do not take Department of Education examinations and whose final marks are therefore subject to teacher influence or bias.

The extraordinary growth of urban high schools has forced administrators to consider new concepts of organization. Furthermore, the possibility of the granting of greater autonomy to the Edmonton Public School system in matters of curriculum suggests that a careful analysis be made of the needs of the students and how they may be met. The advantages of homogeneous ability grouping should be considered. However, before the principle of homogeneous classification of students is accepted, whether for top-ranked students only, or for the entire student body, further study or studies must be made to assess the advantages or disadvantages received by homogeneously grouped students during their high school careers.

A further implication of this study is that equivalent grades

received by pupils from schools using different methods of organization and instruction may not report the same achievement. The same grades may mean different standards of achievement and are therefore misleading. Conformity in pupil assessment can only be achieved with confidence by a standard testing program. This suggests a city-wide program of achievement testing.

Homogeneous grouping of students on the basis of ability or achievement is assumed to provide a better environment for teaching. However, some of the advantages are lost if the grades given to the pupils in such classes do not reflect the more adequate teaching made possible with this type of organization.

The possibility that equal marks received by pupils from different schools may not represent equivalent achievement is particularly serious when a pupil uses his school marks for reference when applying for a job, or when he transfers to another school. His past performance is judged on the basis of the marks which he presents. Parents, future employers and the public may find the varying standards misleading or confusing which could result in skepticism about the actual product being turned out by the school. If standard testing is not provided, transcripts of pupils' marks would have to include information about the type of organization used in the school.

Until all schools rate grade X and grade XI pupils on the same basis, and accept common standards of achievement, employers of high school students will have difficulty in assessing the abilities and academic achievement of potential employees.

Counsellors and administrators who plan programs of studies for pupils moving from one school to another must be aware that the marks presented may be based on varying criteria and therefore do not necessarily convey equivalent information. Under such circumstances, the rank position of a pupil's mean standing, and/or, his class rank, if these are available, might be useful in solving this dilemma.

In conclusion, grading practices should receive the care and attention of administrators and teachers. School administrators, where pupils are grouped homogeneously, may find it necessary to help some teachers develop an awareness of the varying needs of classes of different abilities. Some teachers may require assistance in assessing more accurately individual or class achievement. Therefore, it would appear that the administrator of a school, where pupils are grouped homogeneously, must understand the demands of such organization, and be alert to help teachers understand the needs of their classes. At the same time, a continual analysis of grading procedures should be maintained within each class, and in the entire school to ensure the assignment of valid grades to all pupils.

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APPENDIX A

Tally Sheet Used to Collect Data Used in this Study (sample)

Name	Code #			Grade IX Variables		Grade X Constants	Grade X Electives	
		Sex	S.C.A.T	Literature Science Social St. Mathematics Language Reading	Total	H. & P. D. 10 P. E. 10 Lit. 10 Science 10 Math. 10 Social St. 10 Language 10	Music 10 Art 10 Drama 10 Fab. & Dress 10 Drafting 10 Woodwork 10 Electricity 10 Automotives 10 Record Kp. 10 Shorthand 10 Bus. Fund. 10 Typing 10 French 11 Science 11 Math. 12 Math. 11	Average on Electives *

* This score was used as the eighth grade X variable. It was calculated as a mean score of all the electives taken by the pupil.

APPENDIX B

Distribution of Final Marks in **Electives (Ross Sheppard)**

Score		25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class	x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1					1		2	2		9	5	6	2	6	2				35	357	3835	10.200
2							1	1	6	3	3	4	9	6					33	348	3806	10.545
3					3	1	1	6	10	6	2		1	1					31	244	2042	7.870
4					1	1	1	2	5	9	2	3	3		1				28	253	2415	9.035
5					2	1	1	5	4	6	7	4							30	254	2264	8.466
6				1			4	4	7	5	3	4	1						29	242	2130	9.275
7							1	2	7	4	2	1	1						18	155	1371	8.611
8					2	3	6	4	4	5	2	1	1						28	207	1645	7.393
9				1		2	3	3	6	1									16	109	779	6.812
Total				2	9	8	20	29	49	48	26	23	18	13	3				248	2196	20287	8.854

APPENDIX B

Distribution of Final Marks in **Electives (Strathcona)**

Score		25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class	x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1						1			2	5	4	2	3	1	1				19	191	1997	10.052
2						1	2	1	3	3	7	4	5						26	249	2485	9.576
3						1	2	7	6	2	5	1		1					25	206	1776	8.240
4					1		1	3	3	8	4	1	2						23	202	1848	8.782
5							4	1	7	7	3	2	1						25	214	1894	8.560
6				1	1		2	5	3	6	4	1	1						24	195	1685	8.125
7					1	2	3	5	2	3	1								17	120	890	7.058
8			1	1		2	6	3	4	4	1	1	2						25	185	1515	7.400
9					1	3	2		3	2	1	1							13	94	738	7.231
Total			1	2	4	10	22	25	33	40	30	13	14	2	1				197	1656	14828	8.406

APPENDIX B

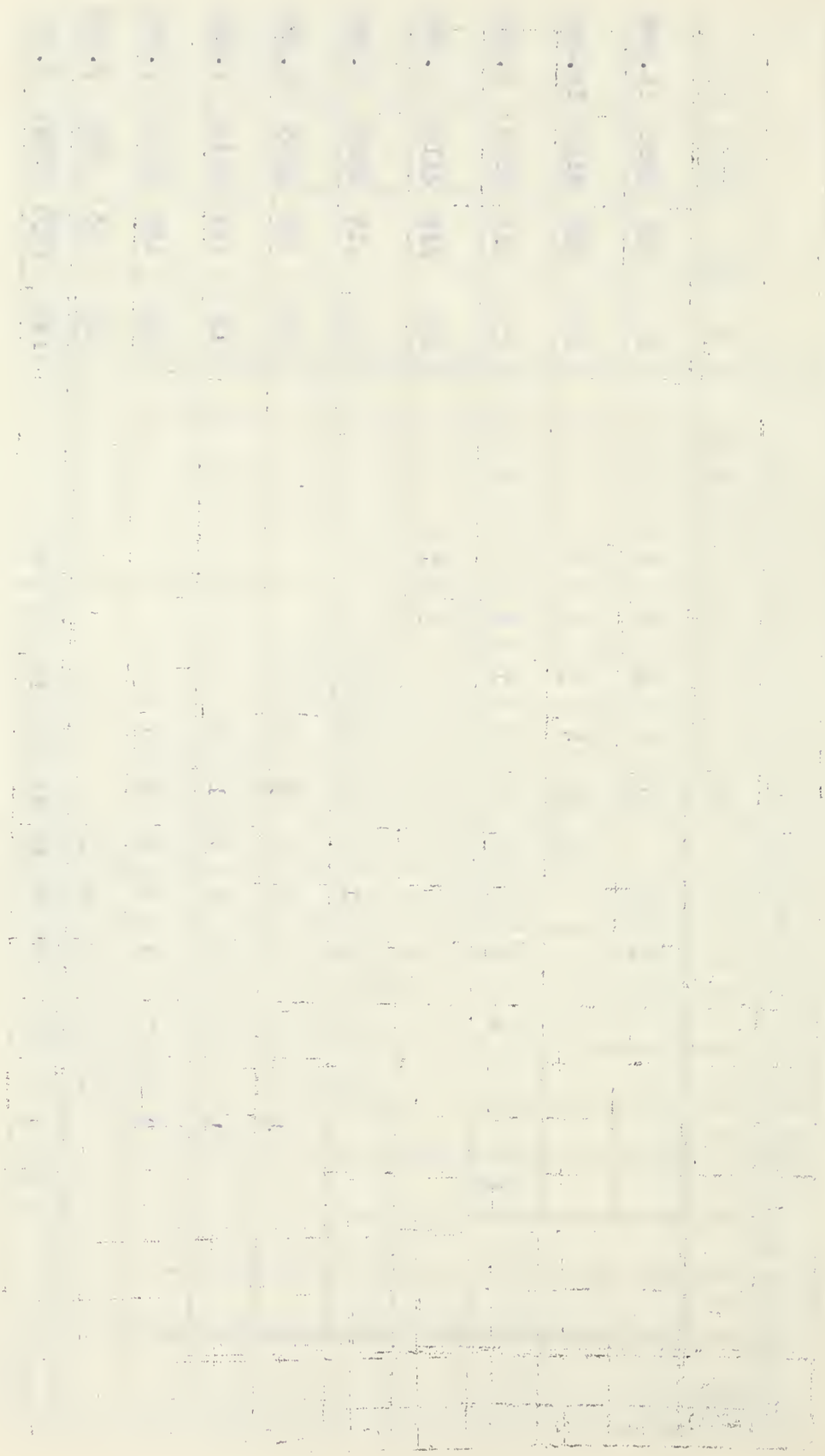
Distribution of Final Marks in **Health & Personal Development (Ross Sheppard)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum X_1$	$\sum X_1^2$	$\overline{X}$
1								1	2	8	8	11	2	2	1			35	395	4533	11.286
2							3	4	10	12	3	1						33	308	2920	9.333
3							4	8	9	7		2	1					31	280	2594	9.032
4							1	9	9	7	2							28	252	2296	9.000
5				1		5	6	6	5	4	3							30	242	2042	8.067
6						3	7	10	7	1	1							29	231	1879	7.996
7					2	3	6	3	3	1								18	131	987	7.278
8				3	5	8	5	5	1			1						28	181	1251	6.464
9				2	1	6	4	3										16	101	661	6.313
Total				6	8	25	36	49	46	40	17	15	3	2	1			248	2121	19163	8.552

APPENDIX B

Distribution of Final Marks in **Health & Personal Development (Strathcona)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1							1	1		2	4	6	3	2				19	218	2560	11.474
2									5	8	4	5	3	1				26	282	3112	10.846
3			1			4	2	3	6	4	3	1	1					25	217	2005	8.680
4						2	2	3	5	5	4		1	1				23	216	2116	9.391
5					1	3	6	1	5	5	2	2						25	214	1926	8.560
6				1	1	3	1	6	3	5	2	2						24	205	1855	8.542
7				1		3	3	4	3	1	2							17	134	1112	7.882
8				2	3	7	1	4	5	2	1							25	180	1390	7.200
9					2	2	2	6	1									13	93	685	7.154
Total			1	4	7	24	18	28	33	32	22	16	8	4				197	1759	16761	8.929



APPENDIX B

Distribution of Final Marks in **Language 10 (Ross Sheppard)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1								1	1	6	5	13	6	2	1			35	409	4853	11.685
2								3	8	12	8	2						33	328	3296	9.939
3						2	2	4	9	7	5	2						31	288	2748	9.290
4							2	10	9	6	1							28	246	2188	8.785
5				1	3	6	11	4	3	2								30	211	1545	7.033
6				1	2	2	7	10	4	3								29	221	1745	7.620
7				2		2	2	3	5	1	3							18	146	1262	8.111
8				4	4	8	4	4	2	2								28	182	1266	6.500
9					1	9	3	2		1								16	106	724	6.625
Total				8	10	29	31	41	41	40	22	17	6	2	1			248	2137	19627	8.616

APPENDIX B

Distribution of Final Marks in **Language 10 (Strathcona)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1								2	1		4	10	2	1				19	220	2586	11.579
2							1	2	3	11	4	5						26	264	2724	10.153
3							6	5	9	2	3							25	216	1906	8.640
4						1	3	4	9	5			1					23	203	1837	8.826
5					1	1	8	9	3			3						25	199	1635	7.960
6				1	1		3	13	4	1		1						24	192	1588	8.000
7				1		4	6	4		1	1							17	123	931	7.235
8				3	4	3	7	5	2	1								25	167	1181	6.680
9				1	2	3	6	1										13	82	532	6.307
Total				6	8	12	40	46	34	27	10	11	3					197	1666	14920	8.456

APPENDIX B

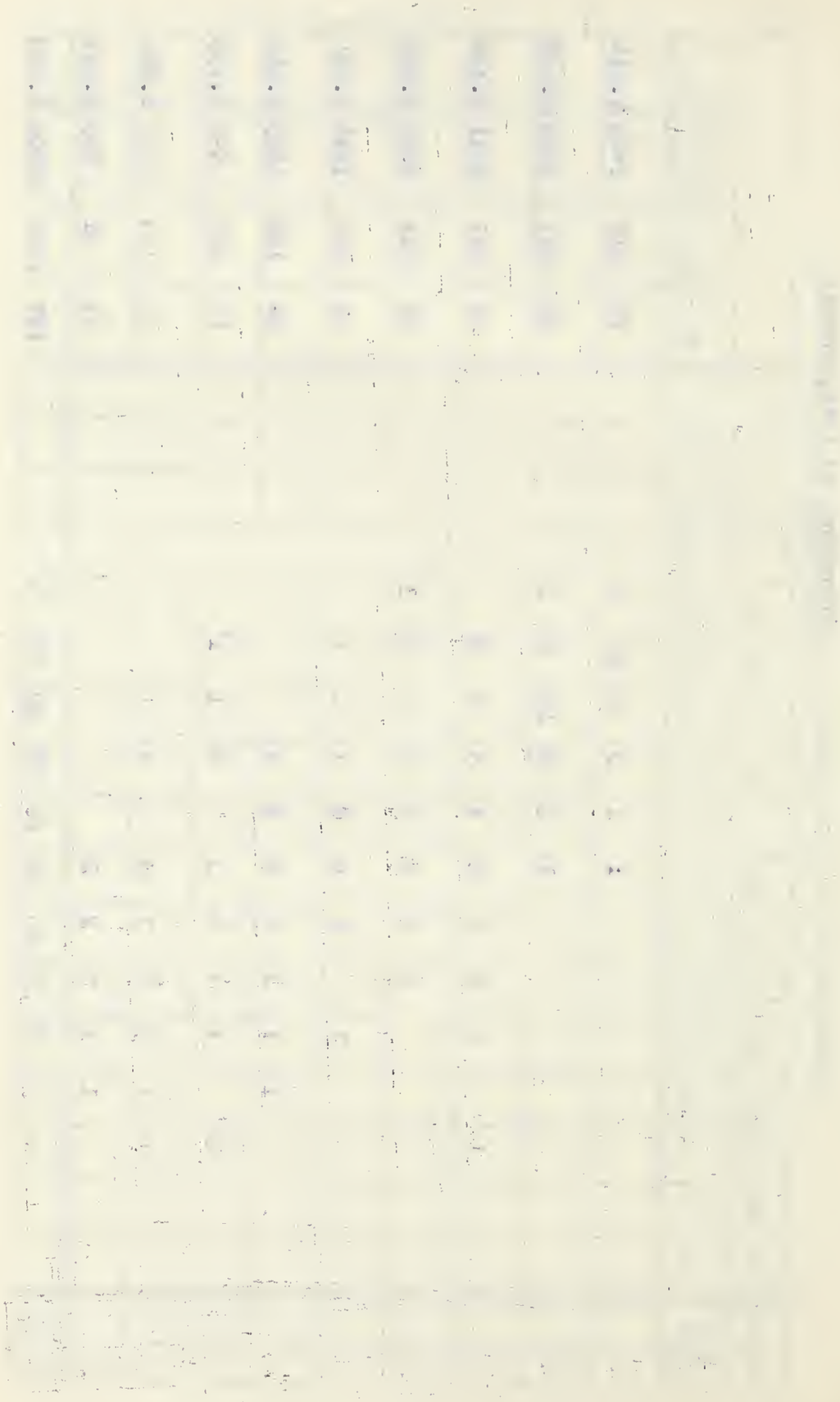
Distribution of Final Marks in **Literature 10 (Ross Sheppard)**

Score		25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class	x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{X}$
1							1		1		3	6	14	8	1	1			35	411	4915	11.743
2									2	4	12	10	5						33	342	3582	10.364
3								3	13	6	4	4	1						31	275	2493	8.871
4								4	6	13	5								28	243	2133	8.679
5							4	9	5	11			1						30	238	1940	7.933
6					1		5	4	11	5	3								29	225	1801	7.759
7						2	1	1	4	3	3	4							18	156	1418	8.667
8						2	7	8	5	3	1	2							28	207	1599	7.393
9						1	7	5	2	1									16	107	731	6.88
Total					1	5	25	34	49	46	31	26	21	8	1	1			248	2204	20612	8.887

APPENDIX B

Distribution of Final Marks in **Literature 10 (Strathcona)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	N	$\sum x_1$	$\sum x_1^2$	$\bar{x}_1$
1								1	1	3	2	10	2				19	215	2465	11.316
2								1	2	6	10	6	1				26	281	3069	10.808
3			1		1	2	1	2	4	5	4	5					25	233	2311	9.320
4						1	3	3	5	7	1	2	1				23	214	2058	9.304
5					1		6	9	6	1	1	1					25	206	1746	8.24
6				1	1	1	4	6	8	3							24	193	1605	8.042
7			2		1	4	3	3		2	1	1					17	123	991	7.235
8			1	1	3	8	7	3		1	1						25	164	1144	6.560
9				1	1	7	2	2									13	81	519	6.231
Total			4	3	8	23	26	30	26	28	20	25	4				197	1710	15908	8.680



APPENDIX B

Distribution of Final Marks in **Mathematics 10 (Ross Sheppard)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1				1		2	1	4	7	6	5	4	3	1		1		35	350	3700	10.00
2						1	1	5	8	6	3	7	1	1				33	329	3389	9.969
3				1	1	3	4	4	10	3	2	3						31	265	2385	8.548
4			2	5	4	3	6	5	2		1							28	175	1203	6.250
5			1	2	1	6	4	5	4	5	1	1						30	229	1887	7.633
6				3	2	6	5	5	4	3	1							29	210	1624	7.241
7				4	3	3	3	1	1	2		1						18	119	883	6.611
8		6	3	6	4	4	1	2		2								28	132	768	4.714
9		6	1	6	2	1												16	55	215	3.438
Total		12	7	28	17	29	25	31	36	27	13	16	4	2		1		248	1864	16054	7.516

APPENDIX B

Distribution of Final Marks in **Mathematics 10 (Strathcona)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1				1				1		2	3	7	1	3	1			19	219	2633	11.526
2							1	5	3	5	3	4	2	3				26	273	2977	9.970
3	1		1			3	5	3	2	1	7	2						25	210	1952	8.548
4				3		3	3	1	3	4	4	2						23	194	1782	8.435
5		1		1	1	8	3	4	4	2	1							25	179	1381	7.160
6				5	1	7	4	2	3	1	1							24	159	1145	6.625
7		2		7	4	1		2	1									17	83	465	4.882
8	1	2	3	2	2	5	3	6			1							25	142	950	5.680
9		3	1	4	2	2		1										13	55	271	4.231
Total	2	8	5	23	10	29	19	25	16	15	20	15	3	6	1			1514	13556	197	7.685

APPENDIX B

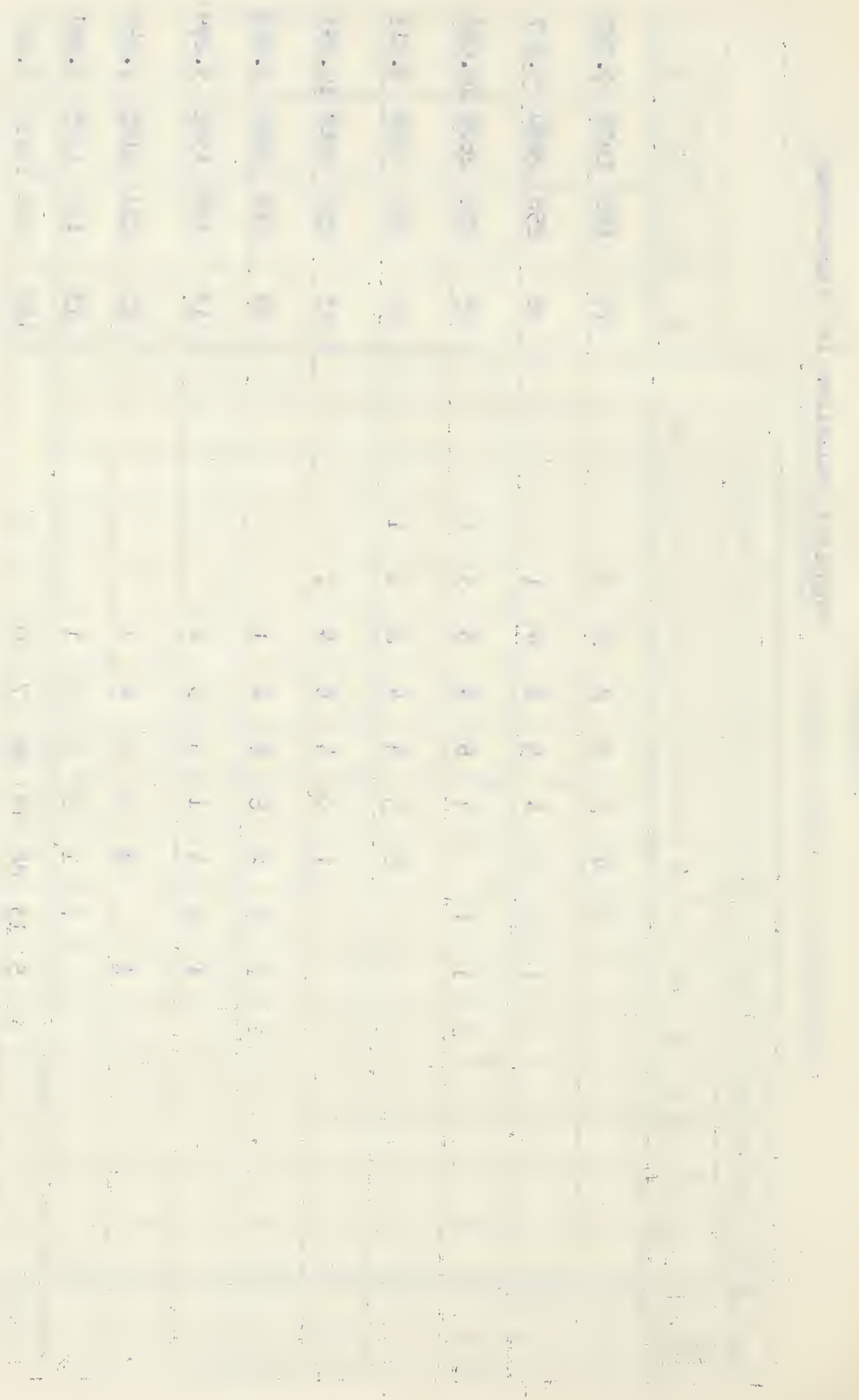
Distribution of Final Marks in **Physical Education 10 (Ross Sheppard)**

Score		25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class	x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1							2	6	13	7	4	1	2						35	296	2574	8.457
2							2	4	8	8	7	1	3						33	293	2681	8.878
3								7	8	6	8	2							31	269	2383	8.677
4							2	6	8	6	3	1	2						28	237	2073	8.464
5						1	3	6	10	7	1		2						30	242	2022	8.066
6						1	2	11	10	4	1								29	220	1700	7.586
7							1	3	10	3	1								18	144	1166	8.000
8					2	2	5	9	8	1	1								28	194	1396	6.928
9							4	3	5	2	1	1							16	124	994	7.750
Total					2	4	21	55	80	44	27	6	9						248	2019	16989	8.141

APPENDIX B

Distribution of Final Marks in **Physical Education 10 (Strathcona)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1							3	4	2	3	2	2	3					19	186	1902	9.789
2						1	3	2	4	5	6	4	1					26	256	2600	9.807
3					2	1	1		4	6	4	3	3	1				25	252	2678	10.080
4								6	5	4	4	2	1	1				23	228	2326	9.913
5								1	9	4	6	4	1					25	256	2664	10.241
6					1	1	3	2	6	6	4	1						24	218	2050	9.083
7						1	2	4	1	4	3	2						17	158	1522	9.294
8						1		8	7	2	6	1						25	231	2185	9.240
9							1	1	6	2	2	1						13	123	1185	9.461
Total					3	5	13	28	44	36	37	20	9	2				197	1908	19112	9.685



APPENDIX B

Distribution of Final Marks in **Science 10 (Ross Sheppard)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1									1	2	11	12	6	2	1			35	415	4971	11.857
2									1	4	15	10	3					33	373	4243	11.303
3							1	1	8	11	6	3	1					31	312	3188	10.064
4						1	3	6	7	6	4		1					28	255	2387	9.107
5					2	1	1	6	7	8	4	1						30	270	2514	9.000
6				1			3	5	5	8	6	1						29	268	2558	9.241
7				2	3		6	1	3	2	1							18	131	1029	7.277
8				3	4	3	6	5	6		1							28	197	1477	7.035
9			1	3	1	4	4	2	1									16	97	631	6.063
Total			1	9	10	9	24	26	39	41	48	27	11	2	1			248	2318	22998	9.346

APPENDIX B

Distribution of Final Marks in **Science 10 (Strathcona)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1					1		1	1	1		2	5	3	5				19	220	2668	11.519
2							3	3	5	3	4	2	3	3				26	269	2911	10.346
3				2	2	1	3	6	4	1	5	1						25	206	1822	8.240
4				1		3	5	3	2	5	3	1						23	194	1730	8.435
5			2	1	2	2	4	5	5	3	1							25	186	1498	7.440
6			1	2	2	4	3	2	8	1	1							24	175	1379	7.292
7	1			3	4	4	2		3									17	98	634	5.765
8		2	1	2	3	8	6	2	1									25	145	915	5.800
9	2	1	1	2		7												13	57	299	4.385
Total	3	3	5	13	14	29	27	22	29	13	16	9	6	8				197	1550	13856	7.868

APPENDIX B

Distribution of Final Marks in **Social Studies 10 (Ross Sheppard)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_i$	$\sum x_i^2$	$\bar{x}$
1						1			3	4	2	12	8	3	1	1		35	416	5070	11.886
2								2	4	12	6	8		1				33	348	3726	10.545
3						1	5	6	7	8	2	1	1					31	279	2587	9.000
4						3	3	6	6	5	4	1						28	247	2253	8.821
5		1		1	1	2	3	9	4	3	4	1	1					30	251	2261	8.367
6				1		5	5	6	8	3	1							29	230	1894	7.931
7				1	2	6	3	2		2	2							18	129	999	7.167
8				3	4	9	4	6	1			1						28	183	1277	6.536
9			1		8	1	2	3			1							16	98	656	6.125
Total		1	1	6	15	28	25	40	33	37	22	24	10	4	1	1		248	2181	20723	8.794

APPENDIX B

Distribution of Final Marks in **Social Studies 10 (Strathcona)**

Score	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100					
Class x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		N	$\sum x_1$	$\sum x_1^2$	$\bar{x}$
1								2	1	2	2	6	4	2				19	219	2583	11.526
2						2	1	3	5	4	4	2	5					26	261	2735	10.038
3				3		1	3	4	5	5	2	2						25	212	1922	8.480
4				1	2	3	2	3	2	4	3	3						23	197	1821	8.565
5				1	2	2	3	6	4	2	3	2						25	208	1844	8.320
6			1	1		5	3	8	2	2	1	1						24	183	1491	7.625
7				1	1	7	1	3	4									17	118	858	6.941
8		1	1	2	5	7	4	2	1	1	1							25	154	1048	6.160
9				3	1	4	2	2	1									13	80	524	6.154
Total		1	2	12	11	31	19	33	25	20	16	16	9	2				197	1632	14826	8.284